MultiRAE

User's Guide



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Product Registration

Register your product online by visiting:

http://www.raesystems.com/support/product-registration

By registering your product, you can:

- Receive notification of product upgrades or enhancements
- Be alerted to Training classes in your area
- Take advantage of RAE Systems special offers and promotions

Contents

⚠ WARNINGS ⚠

Read Before Operating

This manual must be carefully read by all individuals who have or will have the responsibility of using, maintaining, or servicing this product. The product will perform as designed only if it is used, maintained, and serviced in accordance with the manufacturer's instructions.

CAUTION!

Never operate the monitor when the cover is removed. Remove the monitor rear cover or battery only in an area known to be non-hazardous.

ANY RAPID UP-SCALE READING FOLLOWED BY A DECLINING OR ERRATIC READING MAY INDICATE A GAS CONCENTRATION BEYOND UPPER SCALE LIMIT, WHICH MAY BE HAZARDOUS.

TOUTE LECTURE RAPIDE ET POSITIVE, SUIVIE D'UNE BAISSE SUBITE AU ERRATIQUE DE LA VALEUR, PEUT INDIQUER UNE CONCENTRATION DE GAZ HORS GAMME DE DÉTECTION QUI PEUT ÊTRE DANGEREUSE

ONLY THE COMBUSTIBLE GAS DETECTION PORTION OF THIS INSTRUMENT HAS BEEN ASSESSED FOR PERFORMANCE.

UNIQUMENT, LA PORTION POUR DÉTECTOR LES GAZ COMBUSTIBLES DE CET INSTRUMENT A ÉTÉ ÉVALUÉE.

CAUTION: BEFORE EACH DAY'S USAGE, SENSITIVITY OF THE LEL SENSOR MUST BE TESTED ON A KNOWN CONCENTRATION OF METHANE GAS EQUIVALENT TO 20 TO 50% OF FULL-SCALE CONCENTRATION. ACCURACY MUST BE WITHIN 0 AND +20% OF ACTUAL. ACCURACY MAY BE CORRECTED BY CALIBRATION PROCEDURE.

ATTENTION: AVANT CHAQUE UTILISATION JOURNALIERE, VERIFIER LA SENSIBILITE DU CAPTEUR DE LIE AVEC UNE CONCENTRATION CONNUE DE METHANE EQUIVALENTE DE 20 A 50% DE LA PLEINE ECHELLE. LA PRECISION DOIT ETRE COMPRISE ENTRE 0 ET 20% DE LA VALEUR VRAIE ET PEUT ETRE CORRIGEE PAR UNE PROCEDURE D'ETALONNAGE.

CAUTION: HIGH OFF-SCALE READINGS MAY INDICATE AN EXPLOSIVE CONCENTRATION.

ATTENTION: DES LECTURES HAUTES ET HORS D'ECHELLE PEUVENT INDIQUER DES CONCENTRATIONS DE GAZ INFLAMMABLES

CAUTION: SUBSTITUTION OF COMPONENTS MAY IMPAIR INTRINSIC SAFETY.

Note: Users are recommended to refer to ISA-RP12.13, Part II-1987 for general information on installation, operation, and maintenance of combustible gas detection instruments.

The MultiRAE multi-gas detector must be calibrated if it does not pass a bump test, or at least once every 180 days, depending on use and sensor exposure to poisons and contaminants.

SPECIAL CONDITIONS FOR SAFE USE

1. The PGM-62xx shall only be fitted with RAE Systems Battery Pack type M01-3051-000 or M01-3053-000 or Battery Adapter M-01-3052-000 or M01-3054-000 fitted with Duracell MN1500 batteries.
2. The PGM62xx shall only be charged outside hazardous areas.
3. No precautions against electrostatic discharge are necessary for portable equipment that has an enclosure made of plastic, metal, or a combination of the two, except where a significant static-generating mechanism has been identified. Activities such as placing the item in a pocket or on a belt, operating a keypad or cleaning with a damp cloth, do not present a significant electrostatic risk. However, where a static-generating mechanism is identified, such as repeated brushing against clothing, then suitable precautions shall be taken, e.g., the use of anti-static footwear.

1 Standard Contents

The MultiRAE is available in four configurations, each with different kits. Contents of the kits are outlined below.

MultiRAE Pro	MultiRAE
MultiRAE Pro monitor with pump, sensors, battery, and wireless options as specified and protective rubber boot, filter, and belt clip installed	MultiRAE monitor with pump, sensors, battery, and wireless options as specified and protective rubber boot, filter, and belt clip installed
Travel charger / PC communications adapter	Travel charger / PC communications adapter
Desktop charging / PC communications cradle	Desktop charging / PC communications cradle
PC communication cable	PC communication cable
AC adapter	AC adapter
Calibration adapter	Calibration adapter
Alkaline battery adapter (included with rechargeable configurations only)	Alkaline battery adapter (included with rechargeable configurations only)
3 spare filters	3 spare filters
PID sensor cap removal tool	PID sensor cap removal tool
PID zeroing adapter	Hex tool
Hex tool	QuickStart Guide
QuickStart Guide	CD with documentation
CD with ProRAE Studio II instrument configuration and data management software	CD with ProRAE Studio II instrument configuration and data management software
CD with documentation	Calibration and test certificate
Calibration and test certificate	Warranty / registration card
Technical Note TN-106 with ionization energies and correction factors for 300+ VOCs	Technical Note TN-106 with ionization energies and correction factors for 300+ VOCs
Warranty / registration card	Ships in a hard transport case
Ships in a Pelican case	

MultiRAE Lite Diffusion	MultiRAE Lite Pumped
MultiRAE Lite monitor with sensors, battery, and wireless options as specified and protective rubber boot installed	MultiRAE Lite monitor with pump, sensors, battery, and wireless options as specified and protective rubber boot, filter, and belt clip installed
Travel charger / PC communications adapter	Travel charger / PC communications adapter
PC communication cable	PC communication cable
AC adapter	AC adapter
Calibration adapter	Calibration adapter
Alkaline battery adapter (included with rechargeable configurations only)	Alkaline battery adapter (included with rechargeable configurations only)
Hex tool	3 spare filters
QuickStart Guide	PID sensor cap removal tool
CD with documentation	Hex tool
CD with ProRAE Studio II instrument configuration and data management software	QuickStart Guide
Calibration and test certificate	CD with documentation
Warranty / registration card	CD with ProRAE Studio II instrument configuration and data management software
	Calibration and test certificate
	Warranty / registration card

Note: A decontamination plug is standard with the MultiRAE Pro and optional with other models. It enhances the IP rating of the instrument from IP-65 to IP-67 (to dust- and water-proof for temporary immersion).

2 General Information

The MultiRAE is a family of multi-threat gas detectors that combine continuous monitoring capabilities for volatile organic compounds (VOCs), toxic and combustible gases, and radiation, with Man Down Alarm functionality in one highly portable instrument. MultiRAE monitors offer an industry-leading selection of interchangeable field-replaceable electrochemical, combustible, infrared, PID (photoionization detector), and gamma radiation sensors to fit a wide variety of applications. The MultiRAE family's wireless capability elevates worker protection to the next level by providing safety officers real-time access to instrument readings and alarm status from any location for better visibility and faster response.

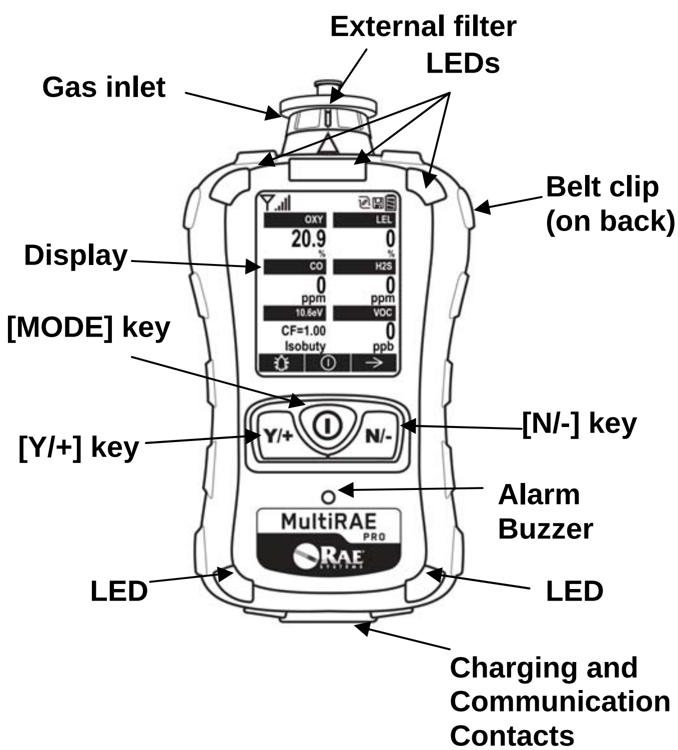
Notes:

- ClO_2 and H_2S sensors cannot be installed in the same instrument.
- NO and NH_3 sensors cannot be installed in the same instrument.
- NDIR combustible sensors are not supported on the diffusion version with CSA certification.
- The PID sensor requires a pumped configuration.

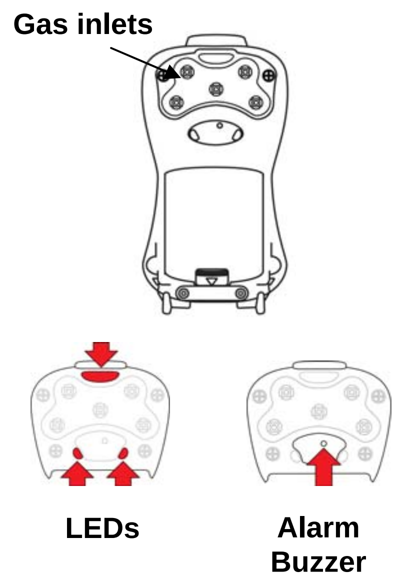
2.1 Key Features

- All-in-one continuous monitoring capabilities for radiation, VOCs, oxygen, toxic and combustible gases, for a total of up to six threats at a time
- Highly customizable with over 30 field-interchangeable intelligent sensor options
- Wireless access to real-time instrument readings and alarm status from any location
- Unmistakable five-way local and remote wireless notification of alarm conditions, including Man Down Alarm
- Large graphical display with easy-to-use, icon-driven user interface
- Simple maintenance with easily accessible sensors, pump, and plug-and-play Li-ion battery
- Fully-automated bump testing and calibration with AutoRAE 2

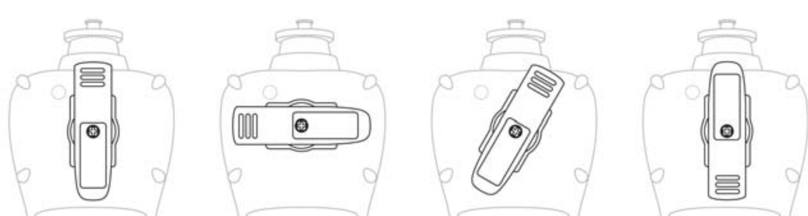
MultiRAE With Pump, front view



MultiRAE Diffusion Model, rear view



Note: The front of the diffusion model of the MultiRAE is the same as the pumped model, but instead of a single inlet, there are five inlets on the back side, as well as an extra alarm buzzer and LEDs.



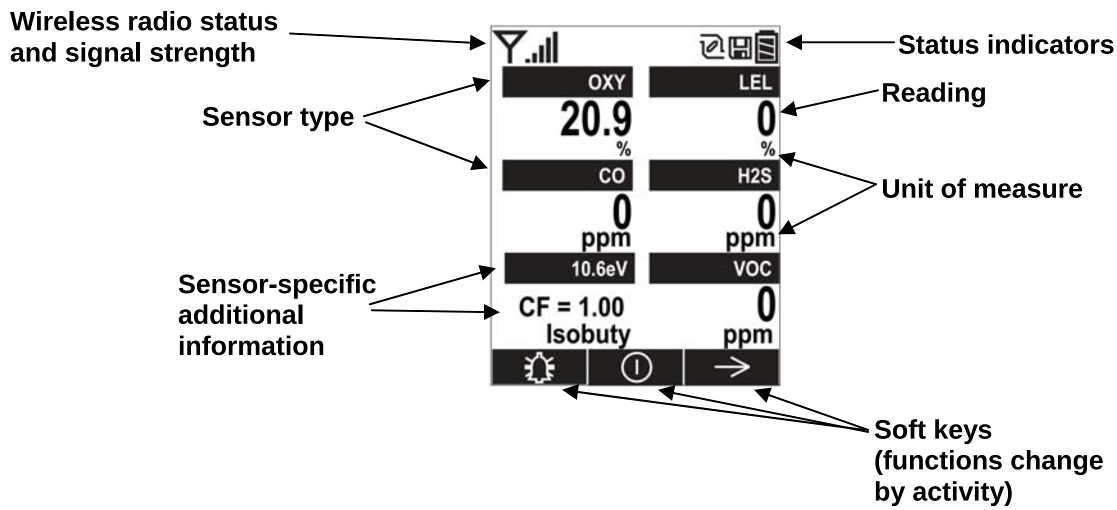
The belt clip on the back of the pump-equipped MultiRAE can be swiveled for holding it at different angles.

3 User Interface

The MultiRAE's user interface consists of the display, LEDs, an alarm buzzer, and three keys.

3.1 Display Overview

The LCD display provides visual feedback that includes the sensor types, readings, time, battery condition, and other functions.



3.1.1 Status Indicator Icons

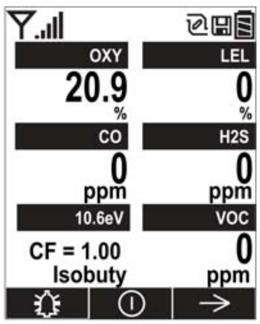
Along the top of most screens are status indicators that tell you whether a function is operating and/or its strength or level.

Icon	Function
	Wireless status (shown when wireless is on, blank when off)
	Wireless strength (0 to 5 bars)
	Pump status (only on pump-equipped models)
	Datalogging status (shown when datalogging is on, blank when off)
	Battery status (three segments show battery charge level)

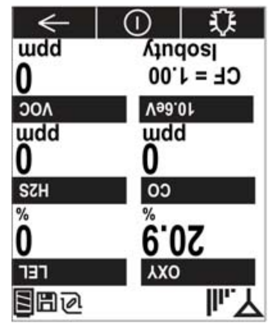
3.1.2 LCD Flip

The MultiRAE senses its vertical/horizontal orientation, and automatically flips the display if it is inverted, making it easy to read if the MultiRAE is upside down. (You can turn this feature on or off in Programming Mode, under "Monitor.")





As the MultiRAE is tilted, the sensor detects its orientation and inverts the screen when it past its horizontal position.



3.1.3 Keys & Interface

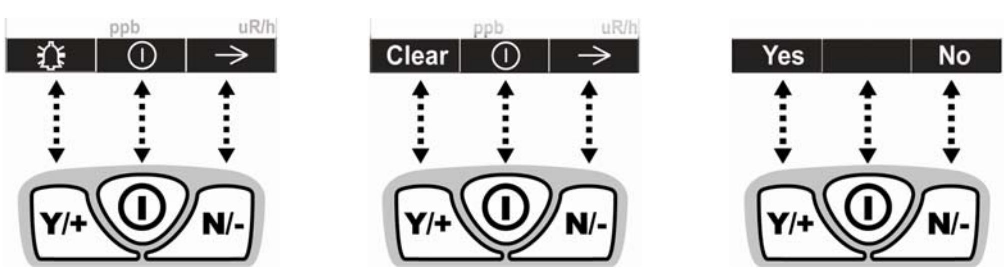
The MultiRAE has three buttons:



Y/+ MODE N/-

In addition to their labeled functions, the keys labeled [Y/+], [MODE], and [N/-] act as "soft keys" that control different parameters and make different selections within the instrument's menus. From menu to menu, each key controls a different parameter or makes a different selection.

Three panes along the bottom of the display are "mapped" to the keys. These change as menus change, but at all times the left pane corresponds to the [Y/+] key, the center pane corresponds to the [MODE] key, and the right pane corresponds to the [N/-] key. Here are examples that show the relationships of the keys and functions:

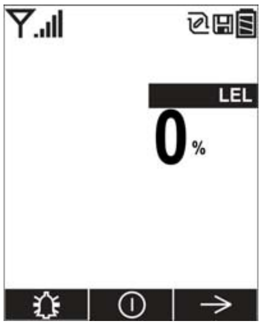


In addition to the functions described above, any of the buttons can be used to manually activate display backlighting. Press any button when the backlighting is off to turn it on.

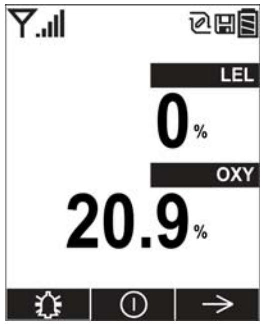
3.2 Screen Display For Various Numbers Of Active Sensors

The MultiRAE family of instruments can accommodate from one to five sensors (some are dual sensors), depending on the configuration. In order to maximize readability and the amount of information shown, the display is automatically reconfigured, according to the number and types of sensors in the MultiRAE.

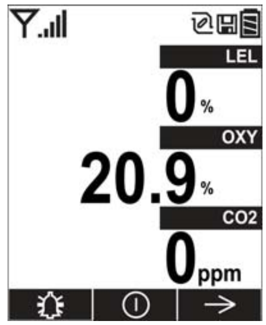
If the configuration includes five sensors, and one of them is a PID, then the lamp value (9.8eV or 10.6eV) is shown, along with the currently applied correction factor (CF).



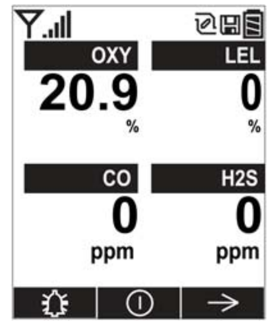
One sensor.



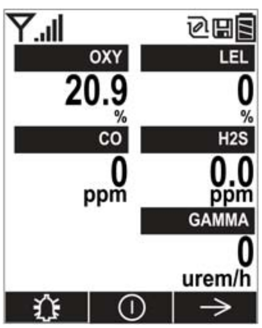
Two sensors.



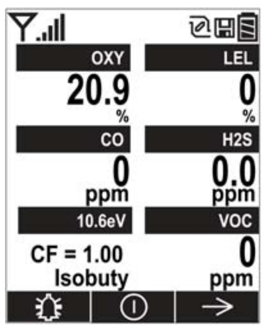
Three sensors.



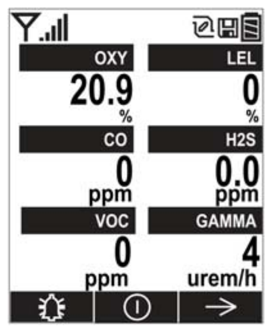
Four sensors.



Five sensors, including Gamma radiation sensor



Five sensors, including PID, showing lamp type and correction factor.



Six-threat configuration with CO+H2S combo sensor

3.3 Menus

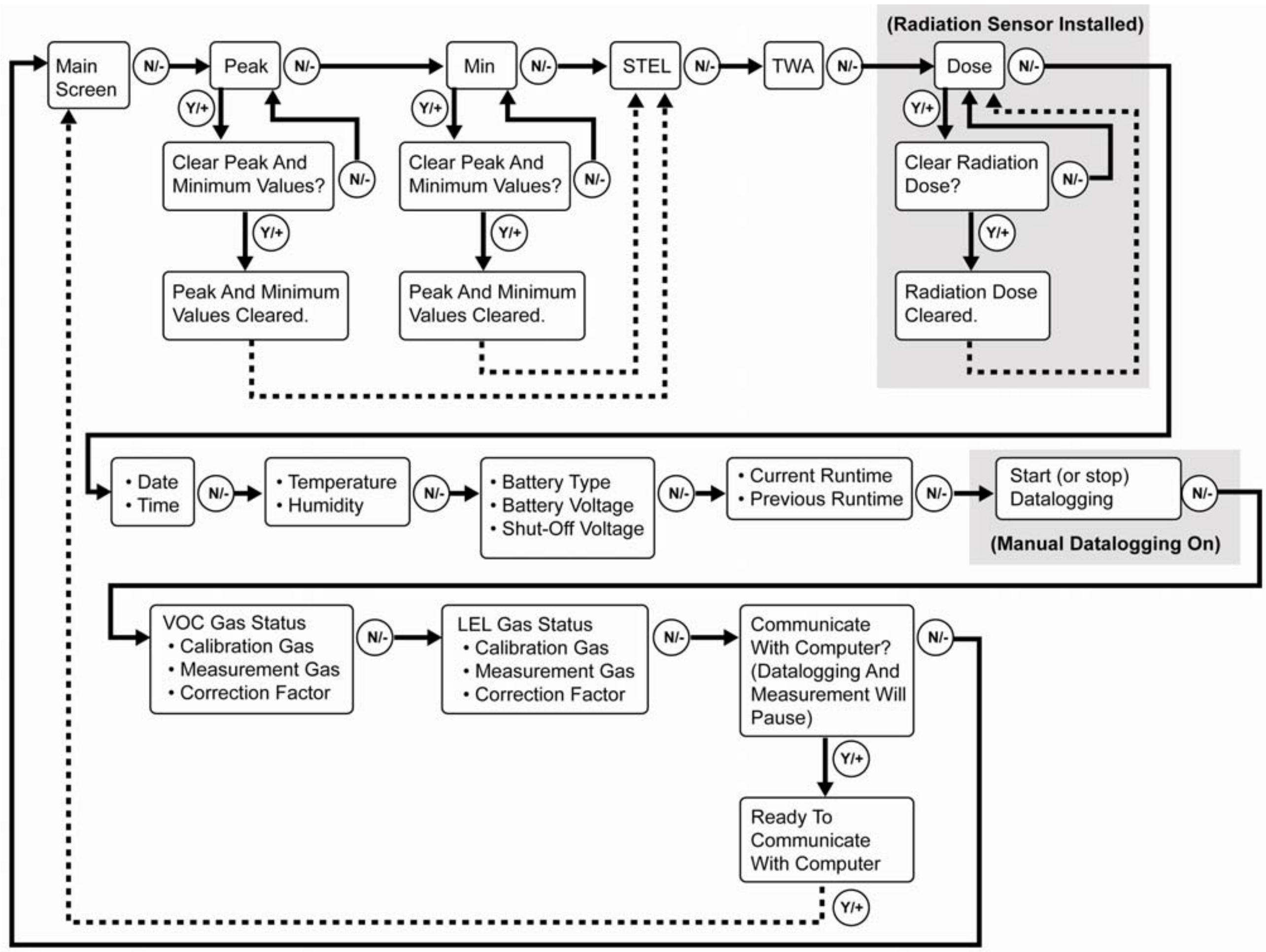
The reading menus are easy to step through by pressing the [N/-] button.

Hygiene Mode, in which sampling is continuous, allows you to clear peak and minimum values at any time.

Search Mode allows you to clear peak and minimum values, but samples only when you tell it to sample. This allows you to save sample readings as individual events in the datalog.

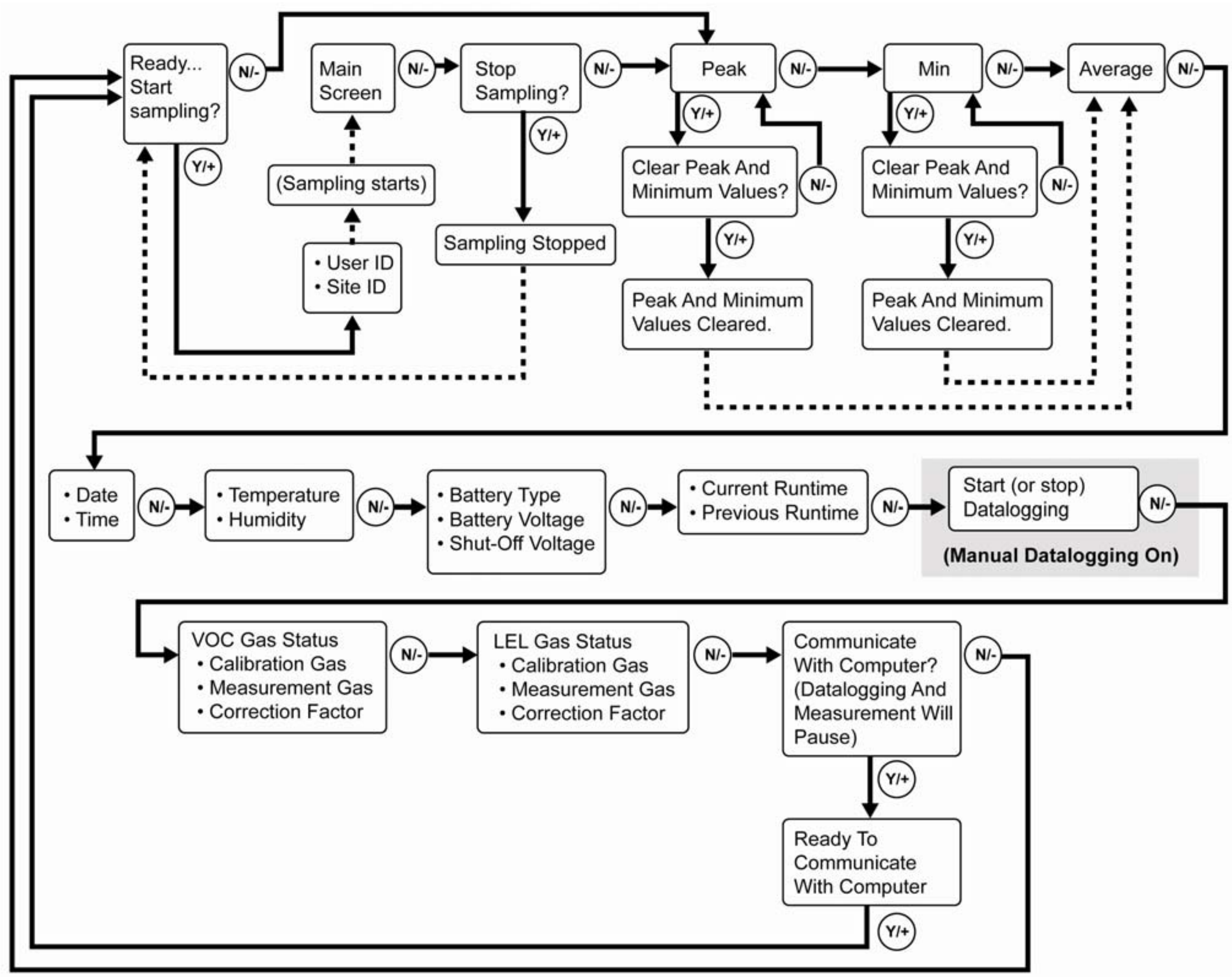
Note: You can switch between Hygiene and Search modes via the Programming Menu (Select Monitor and then Operation Mode).

Hygiene Mode



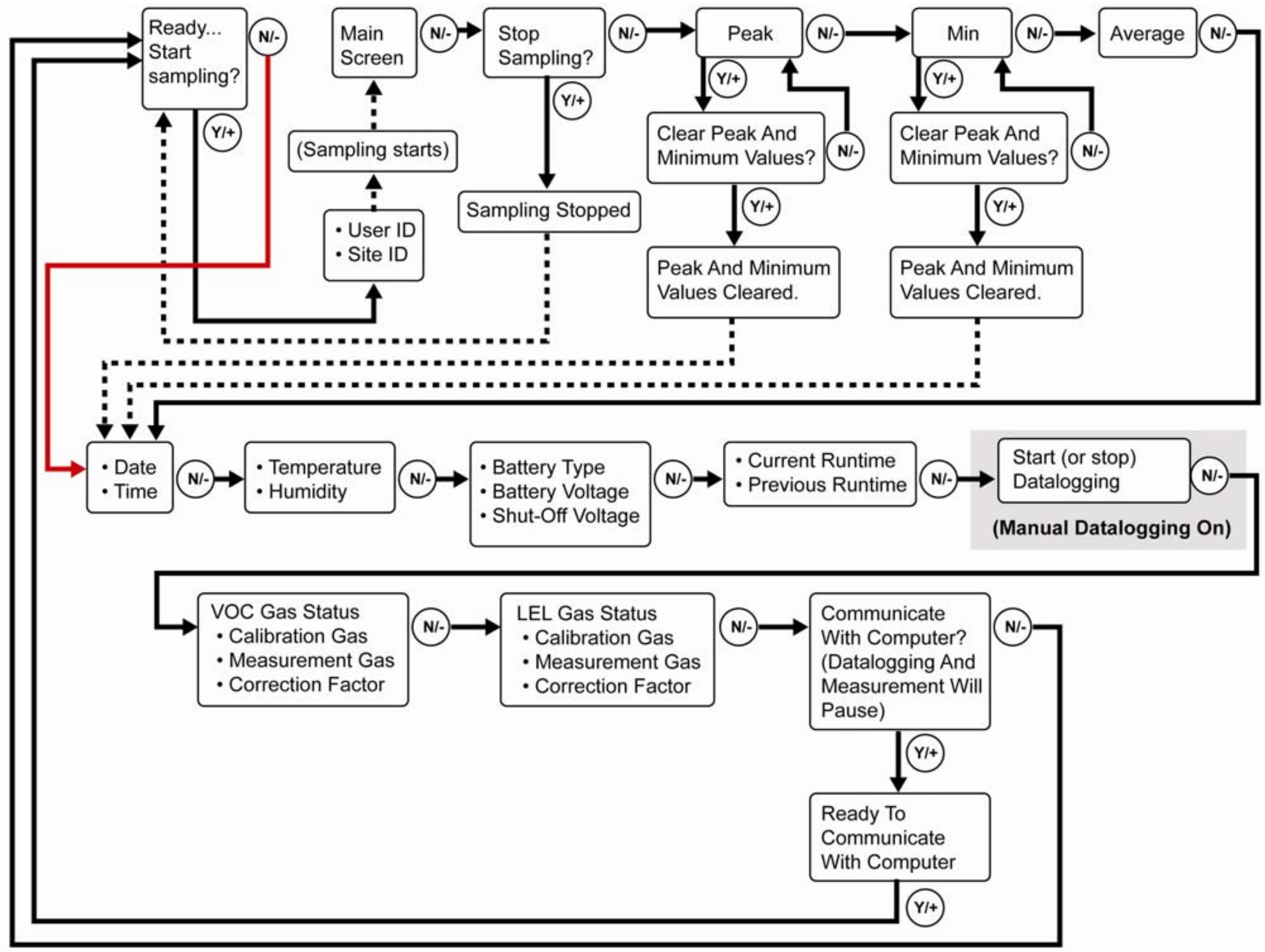
Note: Dashed line indicates automatic progression.

Search Mode



Note: Dashed line indicates automatic progression.

Note: If the Peak or Min is cleared, the Average is also cleared. In addition, each cycle through the main screen after they are cleared will route from "Ready… Start sampling?" directly to Date and Time if you press [N/-] (see red line in diagram below), until you perform a new sample. Also, if you start sampling again and stop sampling, clear the Peak, or clear the Min, it advances to Date and Time, as well.



Note: Dashed line indicates automatic progression.

4 Battery

Always fully charge the battery before using the MultiRAE. Its Li-ion battery is charged by placing the MultiRAE in its cradle or using the travel charger. Contacts on the bottom of the instrument meet the cradle’s contact pins, transferring power.

Note: Before setting the MultiRAE into its charging cradle or attaching its travel charger, visually inspect the contacts to make sure they are clean. If they are not, wipe them with a soft, dry cloth. Do not use solvents or cleaners.

WARNING

To reduce the risk of ignition of hazardous atmospheres, recharge, remove or replace the battery only in an area known to be non-hazardous!

4.1 Using The Charging Cradle

Follow this procedure to charge the MultiRAE:

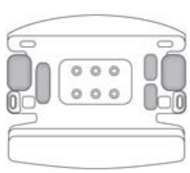
1. Plug the AC/DC adapter into the MultiRAE’s cradle.
2. Plug the AC/DC adapter into the wall outlet.
3. Place the MultiRAE into the cradle and press down until it is locked in place.

The MultiRAE begins charging automatically. The LED in the cradle should glow red to indicate charging. When charging is complete, the LED in the cradle glows green.

4.2 Using The Travel Charger

Follow these steps to use the travel charger.

Before attaching the travel charger, check that it is aligned correctly with the base of the MultiRAE. There are two alignment points on one side and one alignment point on the other side, designed to mate with matching points on the bottom of the MultiRAE:



1. Check bottom of MultiRAE Travel Charger’s alignment pins for correct orientation with the MultiRAE.



2. Align travel charger with bottom of MultiRAE.

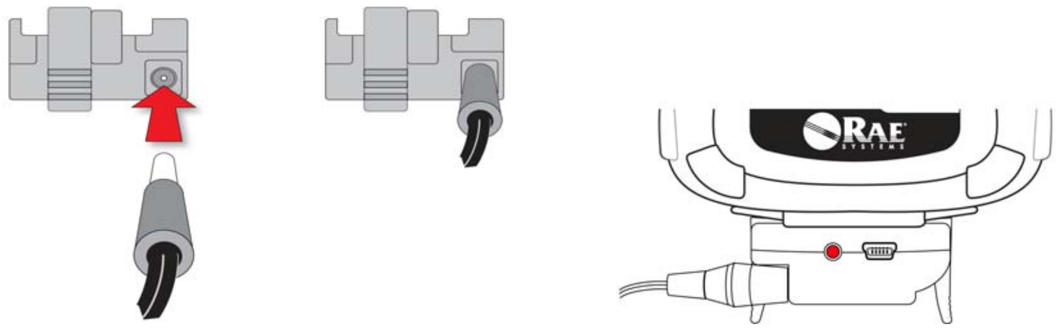


3. Press travel charger onto bottom of MultiRAE.



5. Make sure the travel charger is firmly attached.

Next, put the plug from the power supply into the jack on the side of the travel charger:

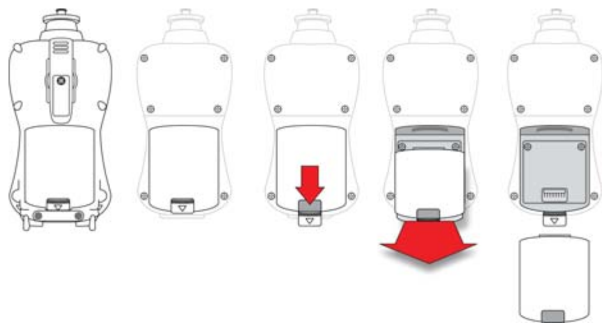


Plug the other end of the charger into a power source (AC outlet or 12VDC mobile power port, depending on the model). When power is applied and the MultiRAE's battery is charging, the LED glows red. The LED glows green when the battery is fully charged.

4.3 Replacing A Battery

The MultiRAE battery packs are plug-and-play, and can be replaced on the go without tools. To replace the MultiRAE battery:

1. Remove the battery adapter from the instrument by sliding the tab and tilting out the adapter. **Note:** The belt clip and rubber boot are removed in the illustration for clarity. They can be left on while replacing a battery.



2. Tilt a fully charged battery (or alkaline battery adapter) into the battery compartment and place it in the instrument.
3. Slide the tab back into place to secure the battery.

4.4 Battery States

The battery icon on the display shows how much charge is in the battery and alerts you to any charging problems.

				
Full charge	**2/3 charge**	**1/3 charge**	**Low charge**	**Battery alert**

When the battery's charge falls below a preset voltage, the instrument warns you by beeping once and flashing once every minute, and the "empty battery" icon blinks on and off once per second. The instrument automatically powers down within 10 minutes, after which you will need to either recharge the battery, or replace it with a fresh one with a full charge.



4.5 Alkaline Battery Pack

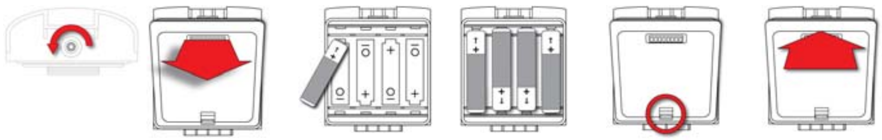
An alkaline battery adapter is supplied with each instrument. The adapter (part number M01-3052-000 or M01-3054-000) is installed and removed just like the rechargeable battery. It accepts four AA alkaline batteries (use

only Duracell MN1500) and provides approximately 8 hours of normal operation. (An optional rechargeable lithium-ion battery pack, part number PN: M01-3053-000, is also available.)

Note: The vibration alarm is disabled whenever the alkaline adapter is used.

To replace the alkaline adapter's batteries:

1. Remove the hex-socket screw at the end of the adapter.
2. Lift the cover off the battery compartment.
3. Insert four fresh AA batteries as indicated by the polarity (+/-) markings.
4. Replace the cover and replace the hex screw.



IMPORTANT!

Alkaline batteries cannot be recharged. The instrument's internal circuit detects alkaline battery pack and will not allow recharging. If you place the instrument in its Travel Charger or Charging Cradle, the alkaline battery will not be recharged. The internal charging circuit is designed to prevent damage to alkaline batteries and the charging circuit when alkaline batteries are installed inside the instrument. If you try to charge alkaline batteries installed in the instrument, the Charging Cradle or Travel Charger's charging LED does not glow, indicating that it will not charge them.

The alkaline battery adapter accepts four AA alkaline batteries (use only Duracell MN1500). Do not mix old and new batteries or batteries from different manufacturers.

Note: When replacing alkaline batteries, dispose of old ones properly.

4.6 Proper Battery Disposal

This product may contain one or more sealed lead-acid, nickel-cadmium (NiCd), nickel-metal hydride (NiMH), lithium (Li), or lithium-ion batteries. Specific battery information is given in this user guide. Batteries must be recycled or disposed of properly.



This symbol (crossed-out wheeled bin) indicates separate collection of waste electrical and electronic equipment in the EU countries. Please do not throw the equipment into the domestic refuse. Please use the return and collection systems available in your country for the disposal of this product.

A Li-Ion battery pack (PN: M01-3051-000 or M01-3053-000) and an alkaline battery adapter (PN: M01-3052-000 or M01-3054-000) are supplied with each MultiRAE.

There are two types of output power for battery packs or adapters. The battery pack (PN: M01-3051-000) and adapter (PN: M01-3052-000) are used for MultiRAE model number PGM-62x0. Battery pack (PN: M01-3053-000) and adapter (PN: M01-3054-000) are used for model number PGM-62x6/PGM-62x8.

The alkaline battery adapter accepts four AA alkaline batteries (use only Duracell MN1500). Do not mix old and new batteries or batteries from different manufacturers. The MultiRAE disconnects the charging circuit if an alkaline battery adapter is installed.

5 Turning The MultiRAE On And Off

5.1 Turning The MultiRAE On

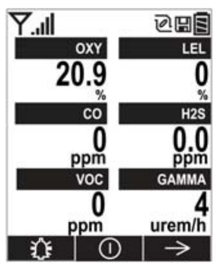
With the instrument turned off, press and hold the [MODE] key until the audible alarm stops, and then release.

When starting up, the MultiRAE turns the backlight on and off, beeps once, blinks once, and vibrates once. A RAE Systems logo (or a company name) should appear first.

This is followed by a progression of screens that tell you the MultiRAE's current settings:

- Product model number, serial number and firmware version.
- List of installed sensors.
- Current date, time and temperature.
- User mode,
- Battery type, voltage, shutoff voltage.
- Alarm mode.
- Datalog period (if it is activated).
- Sensor information such as production/expiration/calibration date and alarm limit settings.

Then the MultiRAE displays instantaneous readings similar to the following screen (depending on the sensors installed) and is ready for use.



Note: If the battery is completely empty, then the display briefly shows the message "Battery Fully Discharged," and the MultiRAE shuts off. You should charge the battery or replace it with a fully charged battery before turning it on again.

5.2 Turning The MultiRAE Off

Press and hold [MODE]. A 5-second countdown to shutoff begins. You must hold your finger on the key for the entire shutoff process until the MultiRAE is powered off.

Caution: The alarm is very loud. During startup, you can mute most of the sound by holding a finger over the alarm port. Do not put tape over the alarm port to permanently mute it.

5.3 Testing Alarm Indicators

Under normal-operation mode and non-alarm conditions, the buzzer, vibration alarm, LED, and backlight can be tested at any time by pressing [Y/+] once.

IMPORTANT!

If any of the alarms does not respond to this test, check the Alarm Settings in Programming Mode. It is possible that any or all of the alarms have been turned off. If all of the alarms are turned on, but one or more of them (buzzer, LED lights, or vibration alarm) does not respond to this test, do not use the instrument. Contact your RAE Systems distributor for technical support.

5.4 Pump Status

IMPORTANT!

During operation, make sure the probe inlet and the gas outlet are free of obstructions. Obstructions can cause premature wear on the pump, false readings, or pump stalling. During normal operation, the pump icon alternately shows inflow and outflow as shown here:



If there is a pump failure or obstruction that disrupts the pump, the alarm sounds and you see this icon blinking on and off:



Once the obstruction is removed, you can try to restart the pump by pressing the Y/+ button. If the pump does not restart, and the pump stall alarm continues, consult the Troubleshooting section of this guide or contact RAE Systems Technical Support.

Note: Pump Status is not indicated on diffusion MultiRAEs.

5.5 Calibration Status

The instrument displays this icon next to the sensor that requires calibration:



Calibration is required (and indicated by this icon) if:

- The lamp type has been changed (for example, from 10.6 eV to 9.8 eV).
- The sensor module has been replaced with one whose calibration is overdue.
- The defined period of time between calibrations has been exceeded.
- If you have changed the calibration gas type without recalibrating the instrument.
- The sensor has failed a previous calibration.

6 Modes Of Operation

The MultiRAE has two operation modes and two user modes.

6.1 Hygiene Operation Mode

Hygiene Mode provides continuous monitoring.

6.2 Search Operation Mode

Search Mode provides monitoring only when monitoring is turned on. This allows specific samples to be taken at different times, rather than continuously.

6.3 Basic User Mode

In Basic User Mode, some restrictions are applied, including password protection that guards against entering Programming Mode by unauthorized personnel.

6.4 Advanced User Mode

In Advanced User Mode, there are no access restrictions (you do not need a password), and MultiRAE provides the indications and data you need most for typical monitoring applications.

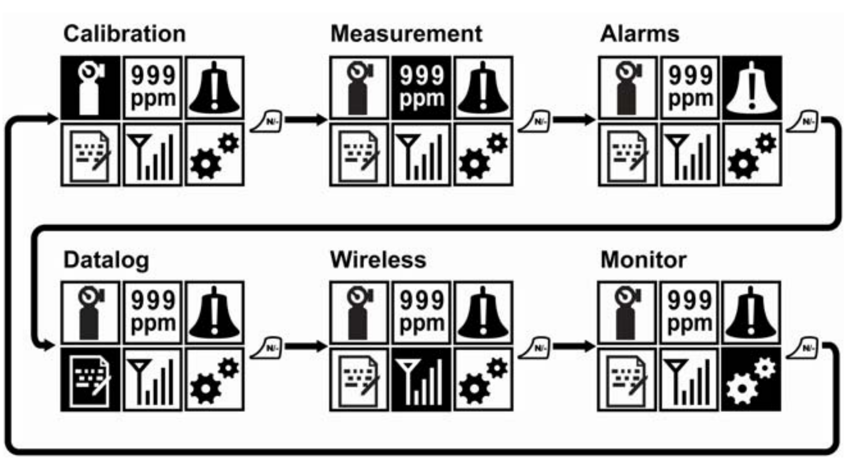
7 Programming

The menu in Programming Mode is to adjust settings, calibrate sensors, and initiate communication with a computer. It has the following submenus:

- Calibration
- Measurement
- Alarms
- Datalog
- Wireless
- Monitor

7.1 Enter Programming In Advanced Mode

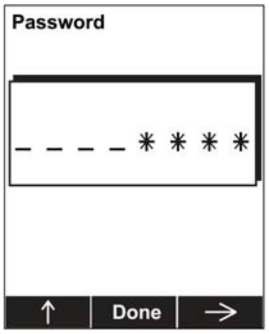
1. To enter Programming Mode, press and hold [MODE] and [N/-] until you see the Calibration screen. No password is necessary in Advanced Mode.
2. Press [N/-] to step through the programming screens.



To enter a menu and view or edit parameters in its submenus, press [Y/+].

7.2 Enter Programming In Basic Mode

1. To enter Programming Mode, press and hold [MODE] and [N/-] until you see the Password screen.



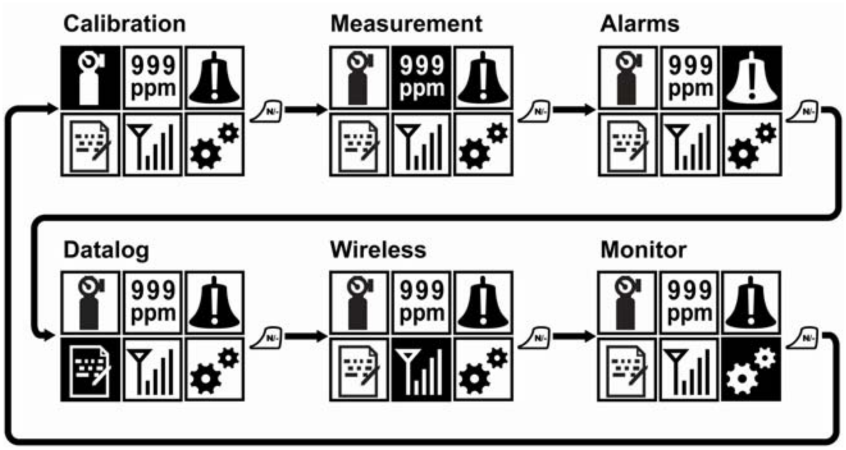
2. Input the 4-digit password:

- Increase the number from 0 through 9 by pressing [Y/+].
- Step from digit to digit using [N/-].
- Press [MODE] when you are done.

If you make a mistake, you can cycle through the digits by pressing [N/-] and then using [Y/+] to change the number in each position.

Note: The default password is 0000.

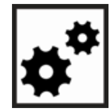
Once you enter Programming Mode, the Calibration screen is shown. Press [N/-] to step through the programming screens.



To enter a menu and view or edit parameters in its submenus, press [Y/+].

7.3 Menus And Submenus

In Programming Mode, menus and submenus are organized as shown here:

					
Calibration	Measurement	Alarms	Datalog	Wireless*	Monitor
Fresh Air	Sensor On/Off	Alarm Limits	Clear Datalog		LCD Contrast
Multi Sensor Span	Change Meas. Gas	Alarm Mode	Datalog Interval		Operation Mode
Single Sensor Zero	Measurement Units	Alarm Settings	Sensor Selection		Pump Speed**
Single Sensor Span		Comfort Beep	Data Selection		Zero At Start
Cal. Reference		Man Down Alarm	Datalog Type		Fast Startup
Change Cal. Gas			Memory Full Action		Temperature Units
Multi Cal Select					Language
Change Span Value					Site ID
Change Span2 Value					User ID
					Date Format
					Date
					Time Format
					Time
					User Mode
					Backlight
					LCD Flip

* Wireless is still in development.
** Pump-equipped version only.

7.3.1 Editing And Selecting Parameters And Sensors

There are a few basic ways to edit parameters, select sensors, and perform other activities in the MultiRAE. The actions performed by pressing keys always match 1-to-1 with the boxes along the bottom of the display and the three keys. Some parameters are edited by scrolling and selecting individual items (black bars behind white text act as highlighters). Some include a choice via "radio buttons," where only one item in a list can be selected, while other menus use boxes for you to "check" with an "X," and these allow for multiple items in a list to be selected. In all cases of editing, you can save or undo your choice.

7.3.2 Calibration

Use this menu to perform zero or span calibration for one or more sensors, and change the gas concentration value assumed to be used in span calibration, as well as zero calibration and calibration reference gas.

7.3.2.1 Fresh Air

This procedure determines the zero point of the sensor calibration curve for all the sensors that require a zero calibration.

7.3.2.2 Multi Sensor Span

Depending on the configuration of your MultiRAE and span gas you have, you can perform a span calibration simultaneously on multiple sensors.

7.3.2.3 Single Sensor Zero

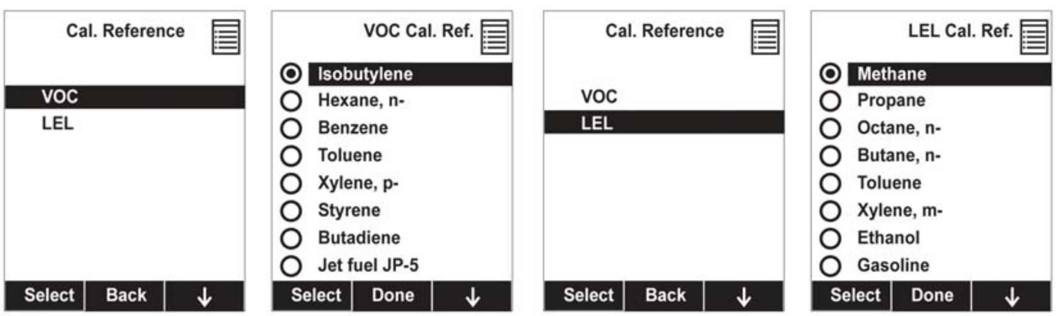
This allows you to perform zero (fresh air) calibration on individual sensors.

7.3.2.4 Single Sensor Span

Instead of performing a span calibration on more than one sensor simultaneously, you can select a single sensor and perform a span calibration.

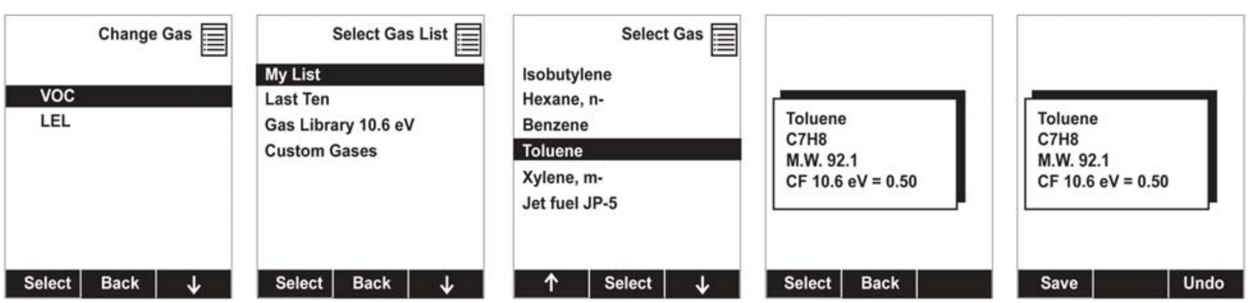
7.3.2.5 Cal. Reference

It is sometimes desirable to calibrate a sensor (PID for VOC, and LEL) with a specific gas for best response to a gas you are surveying. Changing the gas requires selecting the right calibration reference gas in the MultiRAE. Choose the sensor, and then select from the list of reference gases.



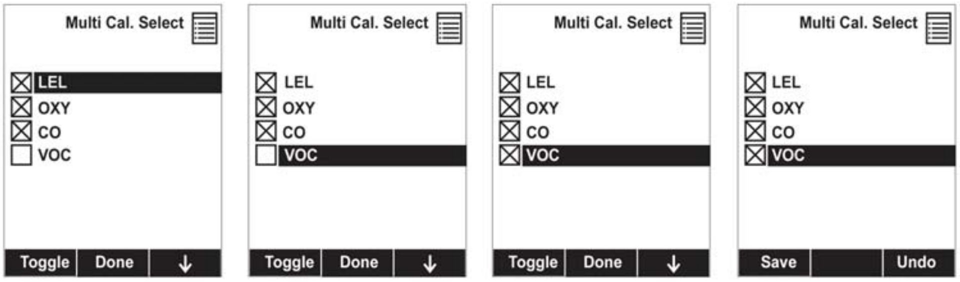
7.3.2.6 Change Cal. Gas

You can change the calibration gas for the MultiRAE's PID and LEL sensors. Select from a custom list that you create (My List), the last ten gases used, the built-in gas library for your PID lamp (taken from RAE Systems' Technical Note TN-106), and custom gases. Each gas is shown in the list for selection and the screen automatically changes to show its full name, chemical formula, molecular weight (M.W.) and correction factor (CF).



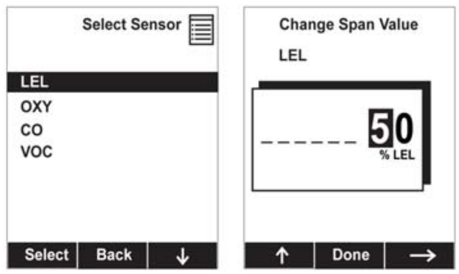
7.3.2.7 Multi Cal Select

You can select one or more sensors to be calibrated at a time. An "X" in a box to the left of a sensor's name indicates it is selected.



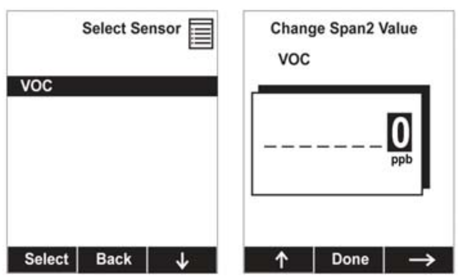
7.3.2.8 Change Span Value

You can individually set the span gas value for each sensor. The units of measure (ppm, %LEL, etc.) are shown on the display.



7.3.2.9 Change Span2 Value

If your MultiRAE is equipped with a PID that has ppb capabilities, you can set the span gas value for a third calibration point (Span2). The unit of measure (ppb) is shown on the display.

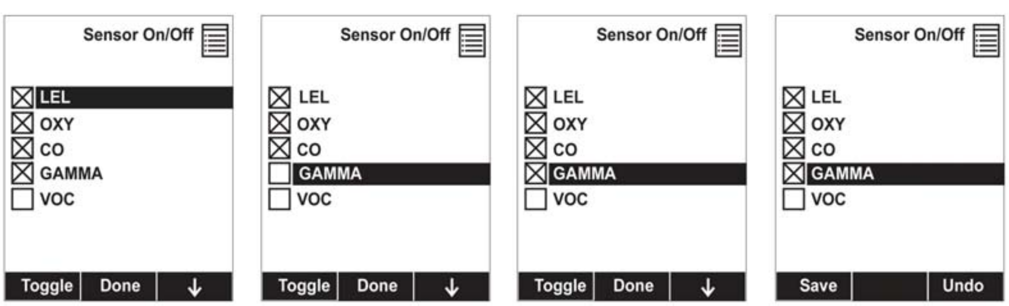


7.3.3 Measurement

The submenus for Measurement include Sensor On/Off, Change Measurement Gas, and VOC and Gamma (if equipped) Measurement Units.

7.3.3.1 Sensor On/Off

You can turn sensors on or off via this set of submenus. An "X" in a box to the left of a sensor's name indicates it is turned on.

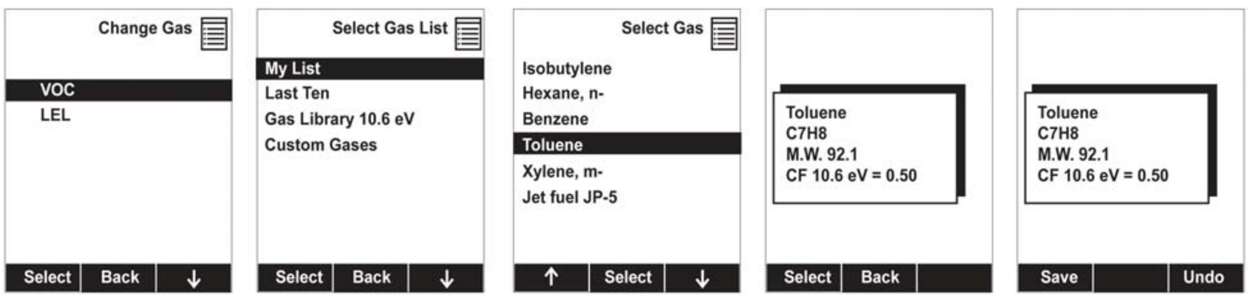


7.3.3.2 Change Meas. Gas

The MultiRAE has extensive onboard gas libraries for combustible gases and VOCs that you can use to configure your MultiRAE to automatically apply the appropriate correction factors and produce readings in the units of the desired combustible gas or VOC.

Measurement gases are organized in four lists:

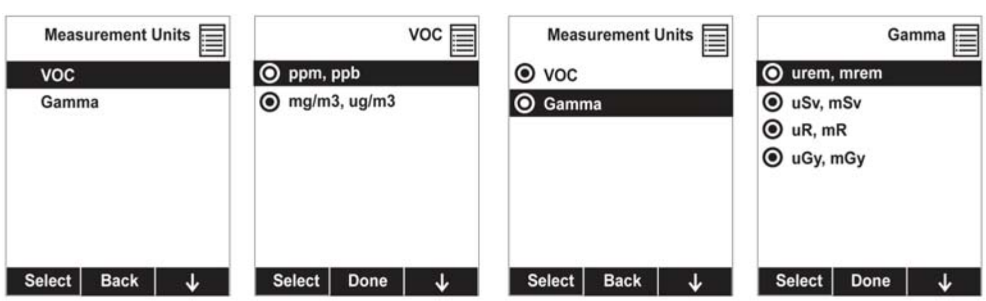
- **My List** is a customized list of gases that you create. It contains a maximum of 10 gases and can only be built in ProRAE Studio II on a PC and transferred to the instrument. **Note:** The first gas in the list is always isobutylene (it cannot be removed from the list).
- **Last Ten** is a list of the last ten gases used by your instrument. The list is built automatically and is only updated if the gas selected from Custom Gases or Library is not already in the Last Ten. This ensures that there is no repetition.
- **Gas Library** is a library that consists of many of the gases found in RAE Systems' Technical Note TN-106 (available online at www.raesystems.com).
- **Custom Gases** are gases with user-modified parameters. Using ProRAE Studio II, all parameters defining a gas can be modified, including the name, span value(s), correction factor, and default alarm limits.



7.3.3.3 Measurement Units

In some cases, the measurement unit for displaying data from sensors can be changed. Standard available measurement units include:

Abbreviation	Unit	Sensor Type
ppm, ppb	parts per million, parts per billion	PID for VOC
mg/m3, ug/m3	milligrams per cubic meter, micrograms per cubic meter	PID for VOC
urem, mrem	microrems and millirems	Gamma
uSv, mSv	microSieverts and milliSieverts	Gamma
uR, mR	microRoentgens and milliRoentgens	Gamma
uGy, mGy	microGrays and milliGrays	Gamma



7.3.4 Alarms

Use this menu to change high, low, STEL, and TWA alarm limits - the points at which alarms are triggered. It can also change alarm mode (latched or automatic reset) and alarm output methods (combinations of light, buzzer, and vibration alarm indications).

7.3.4.1 Alarm Limits

There are four groups of alarm settings, and each allows you access to setting the alarm point for each individual sensor (for example, if the MultiRAE is equipped with three sensors, then you can set the high alarm point for all three separately, low alarm for all three separately, etc.).

Settings:

- High Alarm
- Low Alarm
- STEL Alarm
- TWA Alarm

Note: Some alarm settings are not applicable to all sensors. If a setting is irrelevant to a sensor (for example, STEL for a gamma radiation sensor), then that sensor does not appear in the list.

7.3.4.2 Alarm Mode

You can program the MultiRAE so that there are two ways to shut off an alarm:

Auto Reset	When the alarm condition is no longer present, the alarm stops and resets itself.
Latch	You can manually stop the alarm when one is triggered. The latched setting only controls alarms for High Alarm, Low Alarm, STEL Alarm, and TWA alarm.

7.3.4.3 Alarm Settings

You can enable/disable any combination of light (LEDs), buzzer, and vibration alarms.

Settings:

- All Enabled
- Light
- Vibration
- Buzzer
- Buzzer & Light
- Buzzer & Vibration
- Vibration & Light
- All Disabled

7.3.4.4 Comfort Beep

A Comfort Beep is a single beep of the audible alarm at 60-second intervals that reminds the person using the MultiRAE that it is functioning. It can be turned on or off.

7.3.4.5 Man Down Alarm

The Man Down Alarm is a critical and potentially lifesaving safety feature of every MultiRAE. The Man Down Alarm is based on the premise that if the instrument is motionless when it is not supposed to be, something wrong may be happening to its user. If that is the case, the MultiRAE blasts the alarm not only locally on the instrument, but also remotely, over the RAE Systems Dedicated Wireless Network to notify people in the vicinity, as well as remote safety officers at the command center, that a person is down, so that help can get on the way quickly.

When the Man Down feature is on and there is no gas or radiation alarm, the MultiRAE senses that it is motionless for the amount of time set in the "Motionless Time" parameter. If the instrument is not moved during that time, then a pre-alarm is activated to alert the user, and shows the "Are You OK?" screen. Pressing [Y/+] clears the alarm and returns the MultiRAE to its normal operation. Pressing [N/-] sets it into Man Down Alarm (and if wireless connectivity is enabled, a Man Down message is sent in real time to remote observers). If neither key is pressed, then after the countdown, it goes into Man Down Alarm (again sending a message to remote observers if wirelessly enabled).





Settings are available for:

- Off/On
- Motionless Time (time the instrument is motionless before initiating a pre-alarm)
- Motion Sensitivity (set to low, medium, or high to compensate for ambient vibration or motion)
- Warning Time (countdown, in seconds, from pre-alarm to Man Down alarm)

When the Man Down alarm is activated, the buzzer sounds and LEDs flash continuously, and a countdown begins.

- If the MultiRAE's user presses [Y/+] for "Yes" in response to the "Are You OK?" question on the screen before the countdown reaches zero, the Man Down alarm stops and the main reading screen is displayed.
- If the person does not press [Y/+] for "Yes" in response to the "Are You OK?" question on the screen before the countdown reaches zero, the Man Down alarm is sounded and LEDs flash continuously.
- If the person presses [N/-] during the countdown, answering the "Are You OK?" question with "No," the Man Down alarm starts.

If wireless connectivity is enabled, a Man Down message is also sent to remote observers.

7.3.5 Datalog

The instrument displays a floppy disk icon to indicate that a datalog is being recorded. The instrument stores the measured gas concentration for each sensor, date and time for each measurement, Site ID, User ID, and other parameters. The MultiRAE memory is sufficient to record six months' worth of data for five sensors at one-minute intervals. All data are retained (even after the unit is turned off) in non-volatile memory so that they can be downloaded at a later time to a PC.

7.3.5.1 Clear Datalog

This operation erases all data stored in the datalog.

Note: Once the datalog is cleared, the data cannot be recovered.

7.3.5.2 Datalog Interval

Intervals are shown in seconds. The default value is 60 seconds. The maximum interval is 3600 seconds, and the minimum is 1 second.

7.3.5.3 Sensor Selection

You can choose which sensors' data are included in the datalog. The entire list of installed sensors is shown, and you can individually select whether their data is included.

Note: Turning a sensor off in the list does not change or erase its settings.

7.3.5.4 Data Selection

Data Selection allows you to select which types of data are stored and made available when you download your datalog to a computer via ProRAE Studio II (version 1.04 or higher) software.

You can choose any or all of four types of data (you must choose at least one):

- Minimum
- Average
- Maximum
- Real Time

7.3.5.5 Datalog Type

The instrument offers three options for starting the datalogging process:

Auto	Automatically collects datalog information every time the instrument is sampling until the datalog memory is full.
Manual	Datalogging occurs only when you manually initiate it (see below for details).
Snapshot	Datalogs only during snapshot (single-event capture, initiated by pressing [MODE]) sampling.

Note: You can only choose one datalog type to be active at a time.

About Manual Datalog

When the instrument is set to Manual Datalog, you can turn datalogging on and off by repeatedly pressing [N/-] and stepping through the screens from the main display until you reach the screen that says "Start Datalog?"

- When you reach the screen that says "Start Datalog?" press [Y/+] to start it. You see "Datalog Started," confirming that datalogging is now on. You can turn it off by pressing [Y/+] again.
- If datalogging is running, you can leave it running. However, if you want to turn it off, follow this procedure:
  1. Press [N/-] repeatedly to step through the screens until you reach the screen that says, "Datalog Running."
  2. When the screen says "Stop Datalog?" press [Y/+] to stop datalogging. The screen displays "Datalog Stopped" for a few seconds, before displaying "Start Datalog?" and the datalog interval. You can restart it anytime by pressing [Y/+].

About Snapshot Datalog

When the instrument is in Snapshot datalogging mode, it captures a single "snapshot" of the data at the moment of your choosing. Whenever the instrument is running in Hygiene Mode, all you have to do is press [MODE] each time you want to capture a snapshot of the data at that instant.



No snapshot.



Press [MODE] for snapshot.



Datalog icon is shown during snapshot

7.3.5.6 Memory Full Action
When the internal datalog memory is full, the MultiRAE can either stop collecting data (Stop when full) or go back to the beginning and overwrite the data from the first entry, second entry, etc. (Wraparound).

7.3.6 Wireless
This feature is currently in development.

7.3.7 Monitor
The submenus under "Monitor" control the LCD's contrast, operation mode, pump speed, and other parameters.

7.3.7.1 LCD Contrast
The display's contrast can be increased or decreased from its default setting. You may not need to ever change the default setting, but sometimes you can optimize the display to suit extreme temperature and ambient brightness/darkness conditions.

Use the [Y/+] and [N/-] keys to decrease or increase LCD contrast, respectively. When you are done, select "Done" and save your change or "Undo" to abort changes and revert to the original setting. If no change is made, you can simply exit LCD Contrast.

7.3.7.2 Operation Mode
There are two operation modes, outlined below.

Hygiene Mode
When the MultiRAE is in Hygiene Mode, it continuously monitors, and if datalogging is on, it saves data continuously.

Search Mode
When the instrument is in Search Mode, it only samples when you activate sampling. When you see the display that says, "Ready…Start sampling?" press [Y/+] to start. The pump turns on and the instrument begins collecting data. To stop sampling, press [N/-] while the main display is showing. You will see a new screen that says, "Stop sampling?" Press [Y/+] to stop sampling. Press [N/-] if you want sampling to continue.

7.3.7.3 Pump Speed
If the MultiRAE is equipped with a pump, the pump can operate at two speeds, high and low. Running at low speed is quieter, extends pump lifespan, and conserves a small amount of power. There is almost no difference in sampling accuracy.

7.3.7.4 Zero At Start
If your MultiRAE has been configured to perform a zero (fresh air) calibration upon startup, called Zero At Start, then the startup routine is interrupted so that you can perform a fresh air calibration.

If you do not want to perform a zero calibration, press [MODE] to bypass it. If you start a zero calibration and want to abort it, press [N/-], and the calibration stops and the main display is shown.

7.3.7.5 Fast Startup
Fast Startup skips showing you many settings and is best suited to environments where the MultiRAE is turned on and off very often during a given day. If Fast Startup is not selected, then when the instrument starts, it shows you details of each sensor, including calibration information, high and low alarm settings, etc.

7.3.7.6 Temperature Units
The display unit of the internal temperature sensor can be switched between Fahrenheit and Celsius.

7.3.7.7 Language
English is the default language, but other languages can also be selected for the instrument.

7.3.7.8 Site ID
Choose and enter an 8-digit Site ID to uniquely identify the particular site where the instrument is to be used. The first four digits can be an alphabet letter or number, while the last four digits can only be numbers. This Site ID is included in the datalog report.

Note: Advance through the alphabet and numbers (0 through 9) by one with each press of the [Y/+] key. To scroll quickly, hold down the [Y/+] key for as long as you want it to scroll rapidly.

7.3.7.9 User ID
Enter an 8-digit alphanumeric User ID to uniquely identify a user. This User ID is included in the datalog report.

Note: Advance through the alphabet and numbers (0 through 9) by one with each press of the [Y/+] key. To scroll quickly, hold down the [Y/+] key for as long as you want it to scroll rapidly.

7.3.7.10 Date Format
Month (MM) and Day (DD) have two digits each, while the year (YYYY) uses four digits. The Date can be expressed in three different formats:

- MM/DD/YYYY
- DD/MM/YYYY
- YYYY/MM/DD

7.3.7.11 Date
Set the date according to the format selected in Date Format.

7.3.7.12 Time Format
The time format can be either of these two options:

- 12 Hour (AM/PM)
- 24 Hour

7.3.7.13 Time
Regardless of the Time Format you select, the MultiRAE's time must be set using the 24-hour format, following hours, minutes, and seconds (HH:MM:SS).

7.3.7.14 User Mode
Two User Modes are available: Advanced and Basic. The Advanced User Mode allows a greater number of parameters to be changed than Basic User Mode. It can be used with either of the Operation Modes, Hygiene or Search. No password is required to enter the Programming Menu when in Advanced User Mode.

7.3.7.15 Backlight
The display's backlight can be set to illuminate either automatically, based on ambient light conditions, or manually, or it can be shut off.

7.3.7.16 LCD Flip
The display can be configured to flip 180° automatically when the MultiRAE is turned upside-down. The LCD Flip feature can be set to On or Off.

8 Calibration And Testing

8.1 Bump Testing And Calibration

RAE Systems recommends a bump test be performed periodically on the MultiRAE. A bump test is defined as a brief exposure of the monitor to the calibration gas to show response and trigger the lowest alarm set point for each sensor.

- The MultiRAE multi-gas detector must be calibrated if it does not pass a bump test, or at least once every 180 days, depending on use and sensor exposure to poisons and contaminants.
- Calibration intervals and bump test procedures may vary due to national legislation.

8.1.1 Bump (Functional) Testing

With the MultiRAE in Normal Mode:

1. Connect the calibration gas cylinder, flow regulator, and calibration adapter to the MultiRAE and start the gas flow.
2. Make sure the unit goes into alarm and that the buzzer produces at least two beeps per second, the LED lights flash on and off, and the vibration alarm functions. The display backlight should illuminate and an alarm message should be shown in the display.
3. Turn off the gas flow.
4. Remove the calibration adapter.

8.2 Zero/Fresh Air Calibration

This operation sets the zero point of the sensor calibration curve for clean air. It should be performed before other calibrations.

Note: If you use a zero air cylinder, you must use the MultiRAE Calibration Adapter. Using a calibration adapter is not necessary for calibration in fresh air.

8.2.1 Zero Calibration For A CO_2 Sensor

Important! If your MultiRAE is equipped with a CO_2 sensor, it must be zero calibrated using 100% Nitrogen (N_2), which is inert, instead of fresh air or zero air. You can also use CO_2-free isobutylene, which is convenient to use for zeroing the CO_2 sensor and span calibrating a VOC sensor.

8.2.2 Fresh Air Calibration

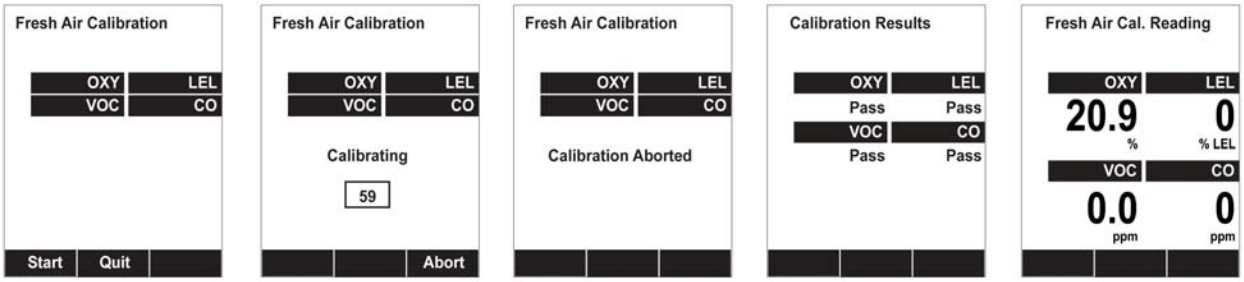
This procedure determines zero points of most sensors.

To perform a fresh air calibration, use a calibration adapter to connect MultiRAE to a "fresh" air source such as that provided by a cylinder. The "fresh" air is clean ambient air without impurities and an oxygen content of 20.9%. If a pure air cylinder is not available, any clean ambient air without detectable contaminants, or clean ambient air drawn through a charcoal filter can be used.

At the Calibration menu, select "Fresh Air" by pressing [Y/+] once to enter fresh air calibration.



After a timer countdown, the zero calibration is done. The LCD will display whether the calibration was successful along with the calibrated readings in fresh air.

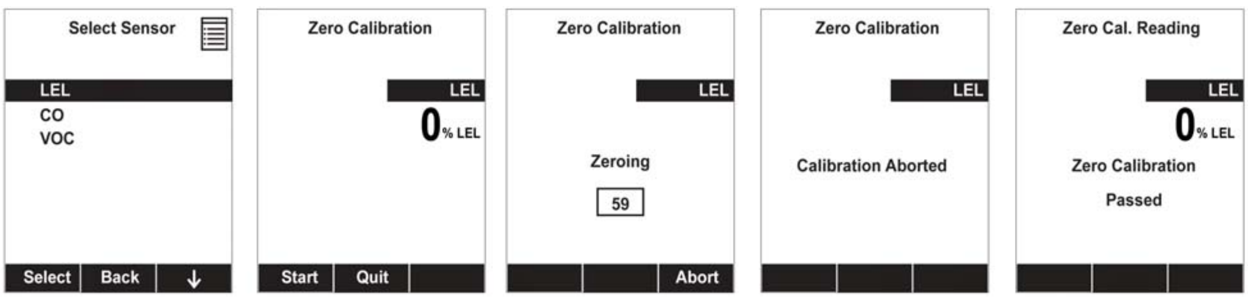


Press [Y/+] to start the calibration. A countdown screen is shown. You can abort the calibration at any time during the countdown by pressing [N/-].

If the calibration reaches its conclusion, the display shows the sensor names and tells you whether each calibration passed or failed, followed by the sensor readings.

8.2.3 Single-Sensor Zero Calibration

Select the sensor and then start the calibration by pressing [Y/+]. You can abort the procedure anytime by pressing [N/-].



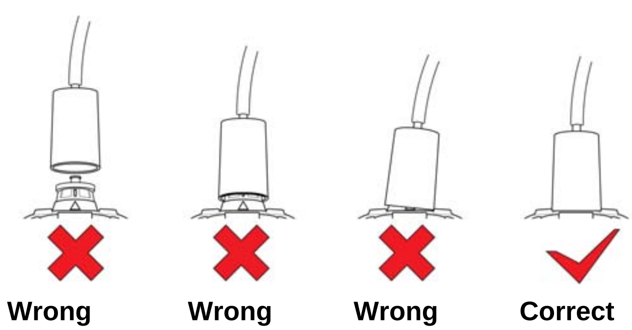
8.3 Span Calibration

This procedure determines the second point of the sensor calibration curve for the sensor.

MultiRAE Equipped With A Pump

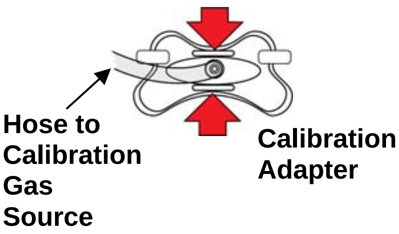
With its pump speed setting of low or high, a MultiRAE normally draws in air at a flow rate of between 200 cc/min and 300 cc/min. RAE Systems recommends that a calibration cap to be used with calibration gas flow rates from 500 cc/min to 1000 cc/min.

WARNING: Make sure the calibration cap clips on and stays in the correct position during calibration, as illustrated below. Otherwise, the calibration cap must be manually held in the correct position.

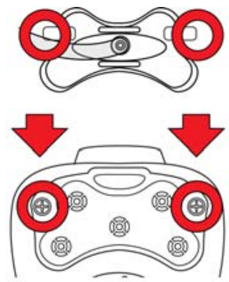


MultiRAE Lite Diffusion Model (No Pump)

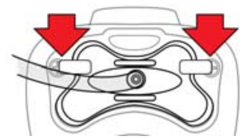
Because there is no single inlet on the diffusion (non-pumped) version of the MultiRAE, a Calibration Adapter is used for supplying calibration gas to all sensors at one time. Follow these steps for attaching the Calibration Adapter.



Grasp the small handles on the Calibration Adapter.



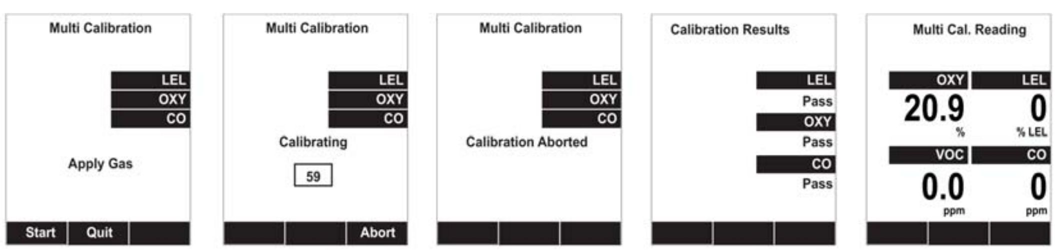
Align the Calibration Adapter's two connectors with the screws on both sides of the MultiRAE's gas inlets.

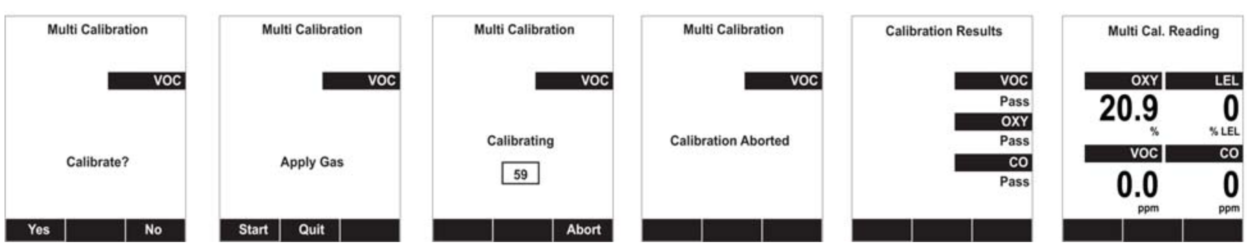


Make sure the connectors are securely in place before starting the flow of calibration gas. (The Calibration Adapter has small grooves on its underside to allow gas to escape after passing over the sensors.

8.3.1 Multi-Sensor Span Calibration

This lets you perform a span calibration on multiple sensors simultaneously. It requires using the appropriate span gas and that the concentration labeled on the gas cylinder matches the concentration programmed in the MultiRAE.





1. Attach the calibration adapter and gas to the MultiRAE.
2. Start the flow of gas and then press [Y/+] to begin calibration. A countdown screen is shown. You can abort the calibration at any time during the countdown by pressing [N/-].

If the calibration reaches its conclusion, it shows the sensor names and tells you whether the calibration passed or failed, followed by the sensor readings.

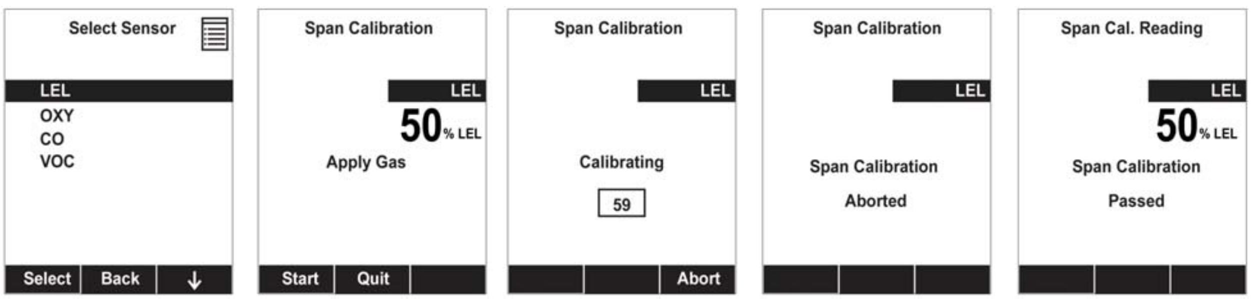
8.3.2 Single-Sensor Span Calibration

This procedure determines a sensor's reading when its target gas is present.

1. At the Calibration Menu, select "Single Sensor Span."
2. Select a sensor from the list.
3. Connect the calibration adapter and connect it to a source of calibration gas.
4. Start the flow of calibration gas.
5. Verify that the displayed calibration value meets the concentration label on the gas cylinder.



6. Press [Y/+] to start calibrating. You can abort the calibration at any time during the countdown by pressing [N/-].



After a timer countdown, the span calibration is done. The LCD will display whether the calibration was successful and the reading for that calibration gas.

Note: If the sensor calibration fails, try again. If calibration fails again, replace the sensor.

Warning: Do not replace sensors in hazardous locations.

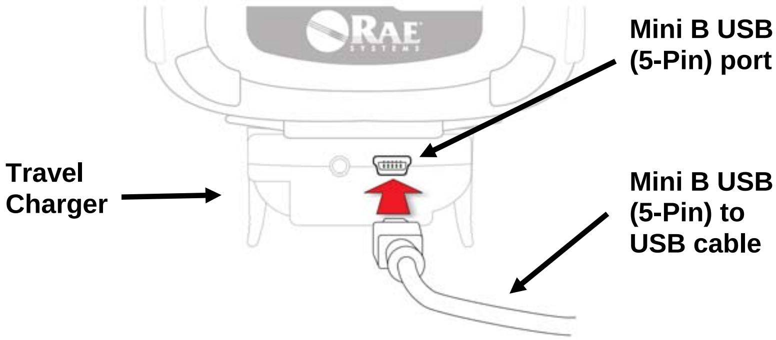
8.4 Testing The Gamma Sensor

The gamma radiation sensor does not require user calibration. You can check it by placing a check-source on the rear of the MultiRAE equipped with a gamma sensor to check the readings. There is a raised dot on the rubber boot that marks where the sensor is located inside the instrument.



9 Datalog Transfer, Monitor Configuration, and Firmware Upgrades Via Computer

Datalogs can be downloaded from the MultiRAE to a computer, and firmware updates can be uploaded to the MultiRAE via the USB port on the Travel Charger or Charging Cradle. Use the included Mini B USB (5-pin)-to-USB cable to connect the Travel Charger or Charging Cradle to a computer running ProRAE Studio II (version 1.04 or higher).



9.1 Downloading Datalogs And Performing PC-Based Instrument Configuration and Firmware Upgrades

The MultiRAE communicates with a PC running ProRAE Studio II Instrument Configuration and Data Management software (version 1.04 or higher) to download datalogs, configure the instrument, or upload new firmware.

The MultiRAE must be connected to a PC through the supplied Charging / PC Communications Cradle and must be in the PC communications mode.

1. Make sure the Charging/PC Communications Cradle or Travel Charger has power from its AC adapter (the LED on the front of the cradle should be illuminated).
2. Use the supplied PC Communications Cable (USB to mini-USB cable) to connect the Cradle or Travel Charger to a PC.
3. Turn on the MultiRAE. Make sure it is running in Normal mode (with the main measurement screen showing).
4. Insert the MultiRAE in the cradle.
5. Activate the PC communications mode on the MultiRAE by pressing [MODE] repeatedly, starting from the main measurement screen until you reach the "Communicate With Computer?" screen.
6. Press [Y/+]. Measurement and datalogging stop, and the instrument is now ready to communicate with the PC. The display now says "Ready To Communicate With Computer."
7. Start up the ProRAE Studio II software, enter a password, and detect the instrument following the directions provided in the ProRAE Studio II User's Manual.
8. Follow the instructions in the ProRAE Studio II User's Manual to download the datalog, configure the instrument settings, or update the MultiRAE's firmware.
9. When you are done, press [MODE] to exit the PC communications mode on the MultiRAE. The instrument returns to operating in Normal mode.

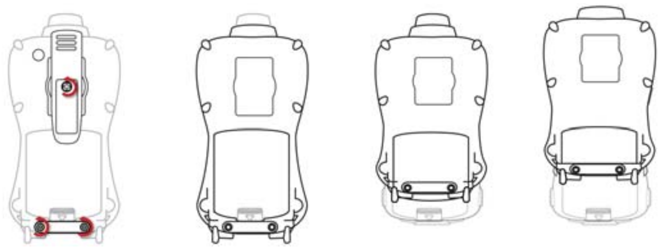
10 Maintenance

The MultiRAE requires little maintenance, aside from replacing sensors, the filter, and the battery. If the instrument is equipped with a pump, it may need replacement, as well. If the instrument has a PID, then the PID sensor lamp and sensor electrode panel may require periodic cleaning.

10.1 Removing/Installing The Rubber Boot

In order to open the MultiRAE, it is necessary to remove the belt clip and the rubber boot. Note that there are two hex screws on the bottom rear side that secure the boot.

1. Remove the belt clip by unscrewing the Philips screw (pumped version only).
2. Remove the two hex screws located below the battery area.
3. Pull the bottom of the boot back over the rear side of the instrument.
4. Carefully slide the boot upward, and slide it over the D-ring and clamp.



10.2 Replacing The Filter

Pumped Version

If a filter is dirty or clogged, remove it by unscrewing it from the inlet. Discard it and replace it with a new filter.



Diffusion Version

If the filters appear dirty, remove the rear cover to access them (this requires removing the rubber boot first).



Remove the four screws holding the sensor compartment cover in place.



Remove the O-rings and then remove the filters. Replace them with new filters and return the O-rings to their proper locations.

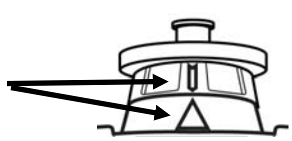


Replace the rear cover and tighten the four screws.

10.3 Replacing The Inlet

When you remove the nozzle, unscrew it in the same manner as the filter. When replacing it, make sure that the arrow on the front points to the triangle on the rubber boot.

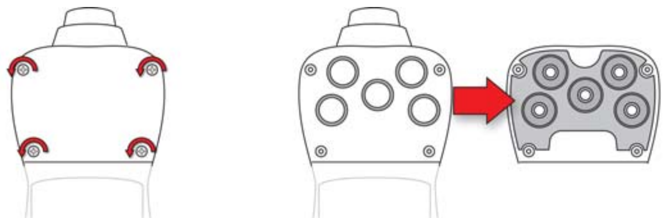
Match arrow on nozzle to triangle on rubber boot



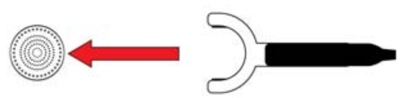
10.4 Removing/Cleaning/Replacing A PID (Pump Version Only)

Note: If you need to access a PID for cleaning or replacement, you must remove the rubber boot and belt clip first.

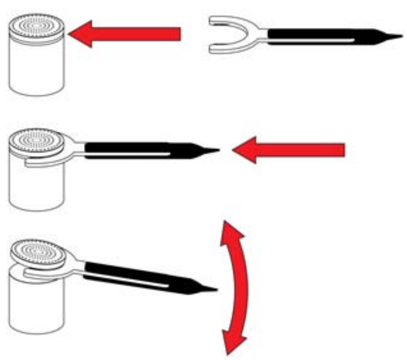
1. Turn off the instrument.
2. Remove the four screws in holding the MultiRAE sensor compartment cover in place.
3. Remove the cover to expose the sensors.



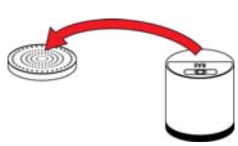
4. Gently lift out the PID module with your fingers.
5. If the module requires replacement (for example, because the lamp does not illuminate, or the module has been used past its expiration date), place a new module into the slot, being careful to match the indexing keys. The sensor can only go into its slot one way.
6. If you want to open the sensor module to inspect and clean the lamp and sensor electrode panel, you must use the special tool (part number G02-0306-003, package of three). Its "C"-shaped end has small "teeth" inside. Slide the tool so that the teeth slip into the notch between the module's cap and body:



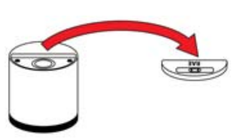
7. Gently pry up the cap using a rocking motion:



8. Once the cap is removed, set it aside.



9. Now lift the sensor electrode panel from the module:



10. Clean the sensor electrode panel in a solution of methanol lamp cleaner (included, along with cleaning swabs, in a PID Lamp Cleaning Kit, part number 081-0002-000), and allow it to dry.

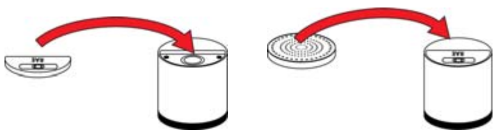
11. Clean the lamp's window with a cleaning swab dipped in methanol lamp cleaner, and allow it to dry. Do not touch the lamp window with your fingers, as the residual oils will shorten its life.



12. Inspect the electrical contacts. Clean them with a swab dipped in lamp cleaner if they appear to need cleaning:



13. Reassemble the sensor module by placing the sensor electrode panel back in place and firmly pressing the cap back onto the top.



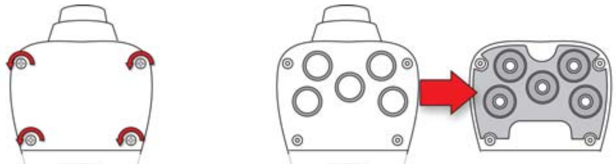
14. Place the sensor module back into the MultiRAE. Make sure the index points are aligned (it can only go in one way).
15. Reinstall the rear cover.
16. Tighten all four screws.

Note: Always calibrate the MultiRAE after replacing the sensor module.

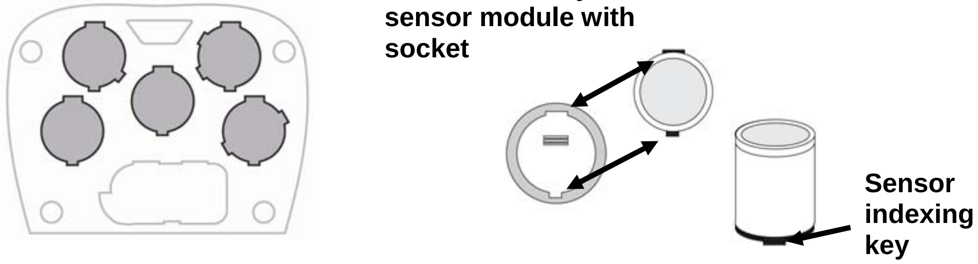
10.5 Removing/Cleaning/Replacing Sensor Modules

WARNING! Do not replace a sensor in hazardous locations.

All sensors are located inside the sensor compartment in the upper half of the MultiRAE. They are accessed by removing the cover that is held on by four screws.



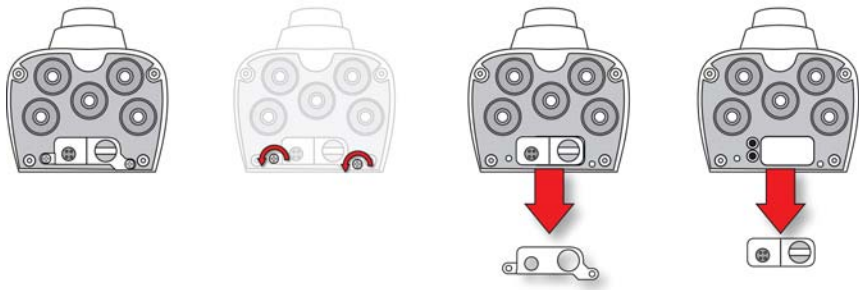
1. Turn off the instrument.
2. Remove the four screws holding the sensor compartment.
3. Remove the cover. The sensors are plugged into the slots.
4. Gently lift out the desired sensor module with your fingers.
5. Install the replacement sensor. It can only go into its slot one way. The connector inside the MultiRAE and the indexing guides are good visual indicators of how to set the sensor into position. Make sure the indexing keys are aligned and that the sensor is seated firmly.



10.6 Replacing The Pump

If your MultiRAE has a pump and it requires replacement, follow these steps. Make sure the battery is removed before proceeding.

1. Remove the rear cover.
2. The pump is held in place by a metal bracket and two Philips screws. Remove the two screws.
3. Lift off the metal bracket.
4. Pressing down on the gas plate with one hand, pull the pump straight out. It has an inlet and outlet that are held in the two holes with rubber gaskets to the left of the pump cavity.



5. Press a new pump into place (a small amount of wiggling helps), making sure that both the inlet and outlet from the pump go into the two holes.
6. Place the metal bracket over the pump.
7. Insert and tighten the two screws that attach the bracket to the housing.
8. Replace the cover.
9. Turn on the instrument and check for proper pump operation.

11 Alarms Overview

The MultiRAE provides an unmistakable five-way alarm notification system that combines local alarms on the device with real-time remote wireless alarm notification to take worker safety to the next level. Local alarms include audible buzzer alarm, visible alarm via bright LED lights, vibration alarm, and an alarm notification on the display. These can be programmed or selectively turned on or off.

Note: The vibration alarm is automatically disabled whenever the alkaline adapter is used.

11.1 Alarm Signals

During each measurement period, the gas concentration is compared with the programmed alarm limits for Low, High, TWA and STEL alarm. If the concentration exceeds any of the preset limits, the alarms are activated immediately to warn both the MultiRAE user and a remote safety officer (if wireless is enabled) of the alarm condition.

In addition, the MultiRAE alarms if one of the following conditions occurs: battery voltage low, pump blocked, PID lamp failed, etc.

When the low battery alarm occurs, there may be approximately 10 minutes of operating time remaining. In this case, it is recommended that you promptly change or charge the battery in a non-hazardous location.

11.2 Changing The Alarm Mode

Your choices are Auto Reset and Latched. A latched alarm stays on until you acknowledge the alarm by pressing a button. An auto-reset alarm turns off when the condition that set off the alarm is no longer present (for instance, a high H2S reading that exceeds the preset threshold and triggers an alarm, but then lowers below that threshold, turning the alarm off).

1. Enter the Alarm Mode sub-menu of the Alarms section under the Programming Menu.
2. Select Auto Reset or Latched by pressing [Y/+].
3. Press [Y/+] to save your selection.

11.3 Alarm Signal Summary

Hygiene Mode

Alarm Type	Buzzer & LED	Display	Vibration	Reading	Backlight	Priority
Super Alarm	4 beeps/sec	"Super Alarm" screen	400ms	-	On	Highest
Man Down Alarm	3 beeps/sec	"Man Down Alarm" screen	400ms	-	On	
Man Down Warning	2 beeps/sec	"Are you OK" screen	400ms	-	On	
Fail	3 beeps/sec	"Lamp" at PID location "Off" at LEL location	400ms	Blinking reading	On	
Pump	3 beeps/sec	Blinking pump symbol	400ms	Reading	On	
Max	3 beeps/sec	"Max" at sensor location	400ms	Blinking reading	On	
Over Range	3 beeps/sec	"Over" at sensor location	400ms	Blinking 9999	On	
High	3 beeps/sec	"High" at sensor location	400ms	Reading	On	
Low	2 beeps/sec	"Low" at sensor location	400ms	Reading	On	
Negative	1 beep/sec	"Neg" at sensor location	400ms	0	On	
STEL	1 beep/sec	"STEL" at sensor location	400ms	Reading	On	
TWA	1 beep/sec	"TWA" at sensor location	400ms	Reading	On	
Calibration	1 beep/sec	"Cal" at sensor location	400ms	Reading	On	
Datalog Full	1 beep/sec	Blinking datalog symbol	400ms	Reading	On	
Calib Due	-	Bottle symbol	-	Reading	-	
Battery	1 beep/min	Blinking battery symbol	400ms	Reading	Stays as is	
Nwk Lost	1 beep/min	Blinking RF offline symbol	400ms	Reading	On	
Nwk Joined	1 beep	RF symbol with RSSI	400ms	Reading	On	
Comfort Beep	1 beep/min no LED flash	-	-	Reading	-	Lowest

Notes

"Negative" means that the reading is below zero.
"Nwk Lost" means "Network Lost." This indicates that the MuliRAE has lost wireless connectivity with its network.
"Nwk Joined" means that the MultiRAE has joined a wireless network.

Search Mode

<table>
<tr><th colspan="2">Alarm Type</th><th>Buzzer & LED</th><th>Display</th><th>Vibration</th><th>Reading</th><th>Backlight</th><th>Priority</th></tr>
<tr><td colspan="2">Super Alarm</td><td>4 beeps/sec</td><td>“Super Alarm” screen</td><td>400ms</td><td>-</td><td>On</td><td>Highest</td></tr>
<tr><td colspan="2">Man Down Alarm</td><td>3 beeps/sec</td><td>“Man Down Alarm” screen</td><td>400ms</td><td>-</td><td>On</td><td></td></tr>
<tr><td colspan="2">Man Down Warning</td><td>2 beeps/sec</td><td>“Are You OK?” screen</td><td>400ms</td><td>-</td><td>On</td><td></td></tr>
<tr><td colspan="2">Fail</td><td>3 beeps/sec</td><td>“Lamp” at PID location
“Off” at LEL location</td><td>400ms</td><td>Blinking reading</td><td>On</td><td></td></tr>
<tr><td colspan="2">Pump</td><td>3 beeps/sec</td><td>Blinking pump symbol</td><td>400ms</td><td>Reading</td><td>On</td><td></td></tr>
<tr><td colspan="2">Max</td><td>3 beeps/sec</td><td>“Max” at sensor location</td><td>400ms</td><td>Blinking reading</td><td>On</td><td></td></tr>
<tr><td colspan="2">Over Range</td><td>3 beeps/sec</td><td>“Over” at sensor location</td><td>400ms</td><td>Blinking 9999</td><td>On</td><td></td></tr>
<tr><td rowspan="7">Geiger Counter style Alarm</td><td>G7 (>High)</td><td>7 beeps(30ms)/sec</td><td rowspan="7">No change</td><td rowspan="7">400ms</td><td rowspan="7">Reading</td><td rowspan="7">On</td><td rowspan="7"></td></tr>
<tr><td>G6</td><td>6 beeps(40ms)/sec</td></tr>
<tr><td>G5</td><td>5 beeps(50ms)/sec</td></tr>
<tr><td>G4</td><td>4 beeps(60ms)/sec</td></tr>
<tr><td>G3</td><td>3 beeps(70ms)/sec</td></tr>
<tr><td>G2</td><td>2 beeps(80ms)/sec</td></tr>
<tr><td>G1 (>Low)</td><td>1 beep(90ms)/sec</td></tr>
<tr><td colspan="2">Negative</td><td>1 beep/sec</td><td>“Neg” at sensor location</td><td>400ms</td><td>0</td><td>On</td><td></td></tr>
<tr><td colspan="2">STEL</td><td>1 beep/sec</td><td>“STEL” at sensor location</td><td>400ms</td><td>Reading</td><td>On</td><td></td></tr>
<tr><td colspan="2">TWA</td><td>1 beep/sec</td><td>“TWA” at sensor location</td><td>400ms</td><td>Reading</td><td>On</td><td></td></tr>
<tr><td colspan="2">Calibration</td><td>1 beep/sec</td><td>“Cal” at sensor location</td><td>400ms</td><td>Reading</td><td>On</td><td></td></tr>
<tr><td colspan="2">Datalog Full</td><td>1 beep/sec</td><td>Blinking datalog symbol</td><td>400ms</td><td>Reading</td><td>On</td><td></td></tr>
<tr><td colspan="2">Calib Due</td><td>-</td><td>Bottle symbol</td><td>-</td><td>Reading</td><td>-</td><td></td></tr>
<tr><td colspan="2">Battery</td><td>1 beep/min</td><td>Blinking battery symbol</td><td>400ms</td><td>Reading</td><td>Stays as is</td><td></td></tr>
<tr><td colspan="2">Nwk Lost</td><td>1 beep/min</td><td>Blinking RF offline symbol</td><td>400ms</td><td>Reading</td><td>On</td><td></td></tr>
<tr><td colspan="2">Nwk Joined</td><td>1 beep</td><td>RF symbol with RSSI</td><td>400ms</td><td>Reading</td><td>On</td><td></td></tr>
</table>

General Alarms

Message	Condition	Alarm Indications
HIGH	Gas exceeds "High Alarm" limit	3 beeps/flashes per second
OVR	Gas exceeds sensor's measurement range	3 beeps/flashes per second
MAX	Gas exceeds electronic circuit's maximum range	3 beeps/flashes per second
LOW	Gas exceeds "Low Alarm" limit*	2 beeps/flashes per second
TWA	Gas exceeds "TWA" limit	1 Beep/flash per second
STEL	Gas exceeds "STEL" limit	1 Beep/flash per second
Crossed pump icon flashes	Inlet blocked or pump failure	3 beeps/flashes per second
"Lamp" flashes	PID lamp failure	3 beeps/flashes per second
Empty battery icon flashes	Low battery	1 flash, 1 beep per minute
CAL	Calibration failed, or needs calibration	1 beep/flash per second
NEG	Zero gas reading measures less than number stored in calibration	1 beep/flash per second

* For oxygen, "low alarm limit" means a concentration is lower than the low alarm limit.

12 Troubleshooting

Problem	Possible Reasons & Solutions
Cannot turn on power after charging the battery	**Reasons:** Defective charging circuit. Defective battery. **Solutions:** Replace battery or charger. Try another charge of battery.
Lost password	**Solutions:** Call Technical Support at +1 408-952-8461 or toll-free at +1 888-723-4800
Buzzer, LED lights, and vibration motor inoperative	**Reasons:** Buzzer and/or other alarms disabled. Bad buzzer. **Solutions:** Check under "Alarm Settings" in Programming Mode that buzzer and/or other alarms are not turned off. Call authorized service center.
"Lamp" message when power on. Lamp alarm.	**Reasons:** Low ion concentration inside PID lamp especially in cold environment when first powered on. Defective PID lamp or defective circuit. **Solutions:** Turn the unit off and back on. Replace UV lamp.
Pump failed message. Pump alarm.	**Reasons:** Inlet probe blocked. Direct connection to a gas outlet while the gas value is turned off. Water trap filter sucks in water. Water trap filter too dirty. Water condensed along the inlet probe. Bad pump or pump circuit. **Solutions:** Remove the blocking objects and then press [Y/+] key to reset the pump alarm. Replace contaminated water trap filter. Be careful not to allow water condensation inside the unit. Replace the pump.

If you need replacement parts, a list is available online:

www.raesystems.com

13 Diagnostic Mode

In Diagnostic Mode, the MultiRAE provides raw counts for sensor, battery, and other readings, as well as a list of installed sensors and information about them (expiration date, serial number, etc.). Most of these screens are useful only to service technicians. A few allow access for changing settings.

The MultiRAE's Diagnostic Mode can only be accessed at startup time. In Diagnostic Mode, MultiRAE displays readings in raw counts instead of units such as parts per million (ppm).

13.1 Entering Diagnostic Mode

1. With the MultiRAE turned off, press and hold both [MODE] and [Y/+].
2. When the display turns on and the password screen appears, release the keys.
3. Enter the 4-digit password (the password is the same as the one for the Programming Mode; the default password is 0000):

   - Step from one position in the four-character string to the other by pressing [N/-].
   - Press [Y/+] repeatedly to select a desired number. Numbers increase from 0 to 9.
   - Once 9 is reached, pressing [Y/+] again "wraps" around back to 0.

4. When you are done, press [MODE]. If you input the correct password, you see the "Product Model" screen.

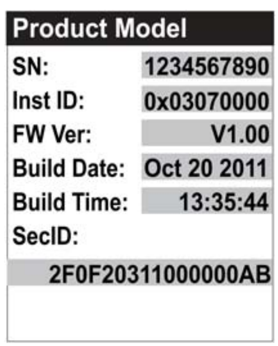
13.2 Exiting Diagnostic Mode

1. Turn off the MultiRAE by pressing and holding [MODE]. There will be a standard shutoff countdown.
2. When the instrument shuts off, you will be alerted. Release your finger.

Note: The next time you start MultiRAE, hold only [MODE], and it will automatically start in Normal Mode.

13.3 Navigating Diagnostic Mode

Step through Diagnostic Mode by pressing [MODE]. The first screen you see is information about the product, including the serial number, firmware version, etc.:



Press [MODE] to advance through the screens:

- Sensor Firmware
- ExtFlash
- Sensor Installed
- Location 1
- Location 2
- Location 3
- Location 4
- Location 5

- Socket Raw Count
- Calibration Data
- Buzzer
- Pump
- Battery
- RTC (real-time clock)
- Lights/Vibrator
- T.H. (temperature and humidity)
- LCD Contrast
- Position Sensor
- Communicate With Computer? (Datalogging And Measurement Will Pause)

14 Specifications

Instrument Specifications

Size	7.6" H x 3.8" W x 2.6" D (193 x 96.5 x 66 mm)
Weight	Pumped models: 31 oz. (880 g) Diffusion models: 26.8 oz. (760 g)
Sensor	Over 30 intelligent interchangeable field-replaceable sensors, including Gamma radiation, ppb and ppm PIDs, electrochemicals for toxics and oxygen, combustible LEL and NDIR, and CO_2 NDIR
Battery Options	• Rechargeable Li-ion (~12 hours runtime, pumped/18 hours, diffusion; < 6 hours recharge time) • Extended duration Li-ion (~18 hours runtime, pumped/28 hours, diffusion; < 9 hours recharge time) • Alkaline adapter for 4 x AA batteries (~ 6 hours runtime, pumped/8 hours, diffusion)
Display	• Monochrome graphical LCD display (128 x 160) with backlighting (activated automatically in dim ambient lighting conditions, when monitor is in alarm, or with a button press) • Automatic screen flipping.
Display Readout	• Real-time reading of gas concentrations; PID measurement gas and correction factor; battery status; datalogging on/off; wireless on/off and reception quality. • STEL, TWA, peak, and minimum values
Keypad	1 operation and 2 programming keys (MODE, Y/+, and N/-)
Sampling	Built-in pump or diffusion. Average flow rate, pumped: 250 cc/min. Auto shutoff in low-flow conditions
Calibration	Automatic with AutoRAE 2 Test and Calibration Station or manual
Alarms	• Wireless remote alarm notification; multi-tone audible (95 dB @ 30 cm), vibration, visible (flashing bright red LEDs), and on-screen indication of alarm conditions • Man Down Alarm with pre-alarm and real-time remote wireless notification
Datalogging	• Continuous datalogging (six months for 5 sensors at 1-minute intervals, 24/7) • User-configurable datalogging interval (from 1 to 3,600 seconds)
Communication and Data Download	• Data download and instrument set-up and upgrades on PC via charging and PC communication cradle, travel charger, or AutoRAE 2 Automated Test and Calibration Station[1] • Wireless data and status transmission via built-in RF modem (optional)
Wireless Network	RAE Systems Dedicated Wireless Network
Wireless Frequency	ISM license-free bands
Wireless Range (Typical)	656 feet (200 meters)
EM Immunity	No effect when exposed to 0.43mW/cm^2 RF interference (5-watt transmitter at 12")
Operating Temperature	-4° to 122° F (-20° to 50° C)

Instrument Specifications *continued*	
Humidity	0% to 95% relative humidity (non-condensing)
Dust and Water Resistance	IP-65 (pumped), IP-67 (diffusion)
Hazardous Location Approvals	Exia Class I, Division 1, Groups A, B, C, D, T4 SIRA 11ATEX2152X, CE 0575 Ex II 1G Ex ia IIC T4 Ga (for PGM62x0/PGM62x6) SIRA 11ATEX2152X, CE 0575 Ex II 2G Ex ia d IIC T4 Gb (for PGM62x8) IECEx SIR 11.0069X, Ex ia IIC T4 Ga (for PGM62x0/PGM62x6) IECEx SIR 11.0069X, Ex ia d IIC T4 Gb (for PGM62x8)
CE Compliance (European Conformity)	EMC directive: 2004/108/EC R&TTE directive: 1999/5/EC ATEX directive: 94/9/EC
Performance Tests	LEL CSA C22.2 No. 152; ISA-12.13.01
Languages	Arabic, Chinese, Czech, Danish, Dutch, English, French, German, Indonesian, Italian, Japanese, Korean, Norwegian, Polish, Portuguese, Russian, Spanish, and Swedish
Warranty	• Two years on non-consumable components and catalytic LEL, CO, H_2S, and O_2 sensors • One year on all other sensors, battery, and other consumable parts
Specifications are subject to change.	

Sensor Specifications

Radiation Sensor	Range	Resolution
Gamma	0 to 20,000 microREM/h	1 microREM/h
PID Sensors	**Range**	**Resolution**
VOC 10.6 eV (HR) VOC 10.6 eV (ppb) VOC 9.8 eV[1]	0.1 to 5,000 ppm 10 ppb to 2,000 ppm 0.1 to 1,000 ppm	0.1 ppm 10 ppb 0.1 ppm
Combustible Sensors	**Range**	**Resolution**
Catalytic bead LEL NDIR (0-100% LEL Methane) NDIR (0-100% Vol. Methane)	0 to 100% LEL 0 to 100% LEL 0 to 100% Vol.	1% LEL 1% LEL 0.1% Vol.
Carbon Dioxide Sensor	**Range**	**Resolution**
Carbon Dioxide (CO_2) NDIR	0 to 50,000 ppm	100 ppm
Electrochemical Sensors	**Range**	**Resolution**
Ammonia (NH_3)	0 to 100 ppm	1 ppm
Carbon Monoxide (CO) Carbon Monoxide (CO), Ext. Range Carbon Monoxide (CO), H_2-comp. Carbon Monoxide (CO) + Hydrogen Sulfide (H_2S) Combo	0 to 500 ppm 0 to 2,000 ppm 0 to 2,000 ppm 0 to 500 ppm 0 to 200 ppm	1 ppm 10 ppm 10 ppm 1 ppm 0.1 ppm
Chlorine (Cl_2)	0 to 50 ppm	0.1 ppm
Chlorine Dioxide (ClO_2)	0 to 1 ppm	0.03 ppm
Ethylene Oxide (EtO-A) Ethylene Oxide (EtO-B) Ethylene Oxide (EtO-C), Ext. Range	0 to 100 ppm 0 to 10 ppm 0 to 500 ppm	0.5 ppm 0.1 ppm 10 ppm
Formaldehyde (HCHO)	0 to 10 ppm	0.01 ppm
Hydrogen (H_2)	0 to 1,000 ppm	2 ppm
Hydrogen Chloride (HCl)	0 to 15 ppm	1 ppm
Hydrogen Cyanide (HCN)	0 to 50 ppm	0.5 ppm
Hydrogen Fluoride (HF)	0 to 10 ppm	0.1 ppm
Methyl Mercaptan (CH_3-SH)	0 to 10 ppm	0.1 ppm
Nitric Oxide (NO)	0 to 250 ppm	0.5 ppm
Nitrogen Dioxide (NO_2)	0 to 20 ppm	0.1 ppm
Oxygen (O_2)	0 to 30% Vol.	0.1% Vol.
Phosgene ($COCl_2$)	0 to 1 ppm	0.02 ppm
Phosphine (PH_3) Phosphine (PH_3), Ext. Range	0 to 20 ppm 0 to 1,000 ppm	0.1 ppm 1 ppm
Sulfur Dioxide (SO_2)	0 to 20 ppm	0.1 ppm

All specifications are subject to change without notice.

LEL Range, Resolution & Response Time

LEL 0-100% 1 % 15 sec

LEL Cross-Sensitivity

Compound	LEL Relative Sensitivity*	LEL CF
Methane	100	1.0
Propane	62	1.6
Propene	67	1.5
n-Butane	50	2.0
Isobutylene	67	1.5
n-Pentane	45	2.2
n-Hexane	43	2.3
Cyclohexane	40	2.5
Benzene	45	2.2
Toluene	38	2.6
n-Heptane	42	2.4
n-Octane	34	2.9
Turpentine	34	2.9
Leaded Gasoline	48	2.1
Methanol	67	1.5
Ethanol	59	1.7
Isopropanol	38	2.6
Acetone	45	2.2
Methyl Ethyl Ketone	38	2.6
Ethyl Acetate	45	2.2
Carbon Monoxide	75	1.2
Hydrogen	91	1.1
Ammonia	125	0.80

* Response of the RAE Systems LEL sensor to a range of gases at the same LEL, expressed as percent of methane response (=100). These figures are for guidance only and are rounded to the nearest 5%. For the most accurate measurements, the instrument should be calibrated with the gas under investigation. See RAE Systems Technical Note TN-156 for more details and other compounds.

Caution:
Refer to RAE Systems Technical Note TN-144 for LEL sensor poisoning.

Year Of Manufacture

To identify the year of manufacture, refer to the serial number of the instrument.

The second to last digit in the serial number indicates the year of manufacture. For example, "M" indicates the manufacturing year is 2010.

First digit	Year
J	2008
K	2009
M	2010
N	2011
P	2012
Q	2013
R	2014
S	2015
T	2016
U	2017
V	2018
W	2019

15 Technical Support

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Critical after-hours support is available:
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